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THE WILSON BULLETIN

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TAWNY FROGMOUTH

Podargus strigoides

Water color from a live specimen captured in early August 1943 in open eucalyptus forest near Wacol, Queensland, Australia.

When captured, the bird emitted loud, rasping wails, then clamped my finger in its bill, nicking the skin with the point of its beak.

The species, which breeds from August to December, is fairly common in Australia and occurs also in Tasmania. Male and female are similar, but some adult females show more reddish in the plumage. It is a nocturnal bird with a silent, owl-like flight. By day it sits upright on a branch in a "dead-stick" attitude, feathers drawn tight, bill pointed in the air, the eyes mere slits. It feeds, usually from a perch, on phasmids and other insects. The call, a repetition of a deep oom oom, carries great distances.

The nest of the Tawny Frogmouth is an open platform of loose sticks placed on a horizontal limb, sometimes as high as forty feet from the ground. The eggs are two or three in number, white, and rounded.—Richard P. Grossenheider.

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THE WILSON BULLETIN
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FOOD AND FEEDING HABITS OF MEXICAN HUMMINGBIRDS

BY HELMUTH O. WAGNER

HUMMINGBIRDS have been variously reported to feed on nectar alone, on nectar and insects in varying proportions, or (at least for limited periods) on insects alone. The viewpoint that hummingbirds feed chiefly on nectar, using insects only as occasional supplementary food, has steadily gained ground (Stresemann, 1927–34; W. Moller, 1930; Porsch, 1926–30). But this opinion is apparently based on merely casual observations, while the results of stomach analyses and field records published by a number of authors lead to a different conclusion.* Wetmore's very careful investigations (1916), in particular, deserve attention. He found 100 per cent animal content in 64 stomachs of three species of hummingbirds from Puerto Rico; while in 59 stomachs of two other species, 98.57 per cent of the contents was animal, 1.43 per cent vegetable. My own observations on the food and feeding habits of hummingbirds, as well as on the related activities, drinking, bathing, and cross-pollination of flowers, are given below. They are limited to Mexico and include data on 19 species.†

Variation In Food With Locality and Season

The food of hummingbirds is determined primarily by habitat and season. A given species may feed mainly on nectar or mainly on insects, depending on the time of year. The majority of the hummingbirds found in Mexico are not dependent on flowers, their migrations being determined by food supply in general rather than by the supply of a particular kind of food. When flowers are lacking, or when the food they provide is inadequate, hummingbirds live on insects and other small animal life.

In the high mountains, hummingbirds depend on animal food for the greater part of the year. They do migrate locally, avoiding the extreme temperatures of winter, but it is only during late summer when

* See, for example, Gould (1861) and the authors quoted by Bent (1940:319–472).

† Thanks are due to Dr. F. Miranda of the Biological Institute, University of Mexico, for identifying the plants; to W. J. Gertsch and C. H. Curran, of the American Museum of Natural History, New York, for carrying out the stomach analyses; to Dr. Erwin Stresemann for the encouragement that has led me to devote an increasing amount of my time to the study of this group of birds; and to Dr. Ernst Mayr for his invaluable suggestions and painstaking correction of the translation.

everything is in flower that they consume nectar in any quantity. Similarly, in regions with a pronounced dry season an adequate supply of nectar is available for only a few months of the year, and hummingbirds of such regions live chiefly on insects. These birds are, however—and probably without exception—also forced to make regular local migrations. They are found during the dry season in the gallery forests along the streams intersecting their range, where an abundant insect life ensures them adequate food the year round. Following the first rainfall in summer, when the arid regions and barren mountains are green and in blossom again, the hummingbirds return there, and then supplement their animal food with nectar.

On the other hand, there are some species that feed largely on nectar and are in consequence dependent on blossoming plants. I have found them only in the tropical regions of Mexico. Individuals of such species occur in the more northern regions only as summer residents. They do not occur in the high mountains or in areas with a pronounced dry season, even as visitants. Flowers the year round are for them a vital necessity, and consequently they can live only in regions, such as the tropical forests, where climatic changes are slight. Even here their specialized feeding habits force them to make regular local migrations.

An independent confirmation of the pronounced difference in food habits between tropical and highland hummingbirds is supplied by the following observations: On several occasions I took some 40 or 50 live hummingbirds from Mexico and the West Indies to European zoological gardens. En route they were fed the usual mixture of honey, raw sugar, etc. It was not possible to give them the live insects (*Drosophila* sp.) that they are fed in zoological gardens. In the course of years I found that species from the coast of Veracruz and from Havana fared better in captivity than those from the highlands of Mexico. Since species from the warm tropical coasts feed regularly on nectar, they can live without difficulty on the artificial food mixture, which is very similar to their natural food. The birds from the high mountains, on the other hand, had been feeding at the time of capture (March to April) almost entirely on insects. They readily took the syrup offered to them, but it was not an adequate substitute for the food they had been eating, and they soon died of an intestinal affection.

Data from zoological gardens show that Brazilian hummingbirds endure captivity especially well, surviving as long as two years. Since these birds come from the tropical valley of the Amazon, where they feed mainly on nectar, the artificial food given them in captivity suits their requirements.

Modes of Feeding

Hummingbirds feed while on the wing, whether they are extracting nectar from flowers, gathering insects from the vegetation, or capturing flying insects. Usually hummingbirds while perched will capture an insect only if they chance to see one in their immediate vicinity. I have

seen but one species assume a perch for the purpose of feeding. In April, near Mexico City, I regularly observed Heloise's Hummingbird (*Atthis h. heloisa*) feeding at the blossoms of a large tree (*Erythrina americana*). They sometimes hovered before the blossoms but immediately perched on the stem whenever the position of the flower made this possible (Figure 1). Then they inserted the bill between the long bifurcate petals.

Nectar

On the Pacific coast of Chiapas, I observed two species of hummingbird that were predominantly nectarivorous. Near my camp, an enormous leafless tree was in full bloom. It was filled morning and evening with Cinnamomeous Hummingbirds (*Amazilia r. rutila*) and Prevost's Mangos (*Anthracothorax p. prevostii*). The two species divided the tree between them, the Cinnamomeous Hummingbirds taking complete possession of the lower branches of the tree, the Prevost's Mangos occupying the top. If a bird of either species crossed the invisible boundary line that divided the two parts of the tree, it was immediately driven back to its own territory.

From this tree I collected 2 Prevost's Mangos and 8 Cinnamomeous Hummingbirds; the stomachs and crops of all 10 specimens were filled with nectar, a thick whitish liquid, sweet and palatable. With the

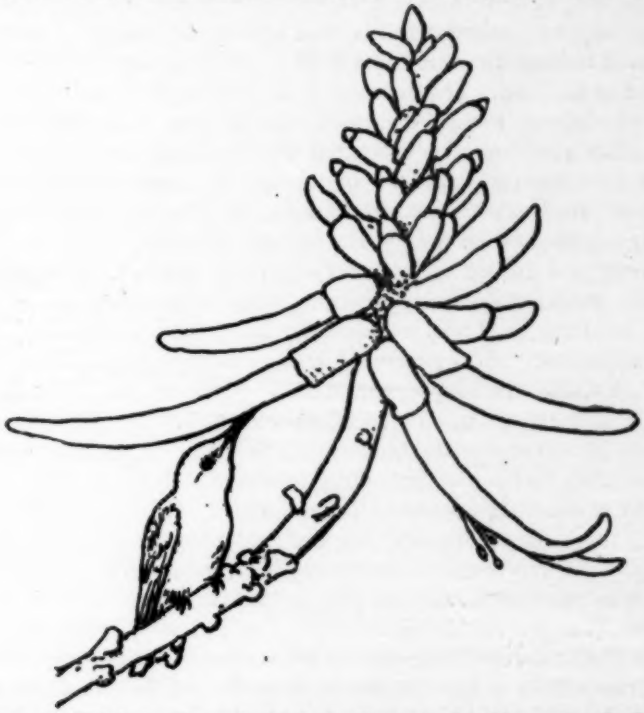

Figure 1. Heloise's Hummingbird feeding at the blossoms of *Erythrina americana*.

nectar a few insects had been taken by one of the Mangos, and two spiders by one of the Cinnamomeous Hummingbirds, but possibly only by accident.

Nectar is so very rapidly used up that large quantities must be stored in the crop for use in periods of inactivity—during the night and during the middle of the day when the temperature of the habitat often reaches 104° F. in the shade. It is known that captive hummingbirds drink daily a quantity of liquid equal to twice their own weight, but this actually tells us very little. In my experience, the amount of liquid consumed by captive birds varies with the sugar content. Since the syrup fed them is more concentrated than the rather watery nectar from flowers, the volume of natural nectar consumed is probably much greater than the amount of syrup determined for captive birds. The fact that carbohydrates are rapidly consumed is probably related to the fact that nectar is the chief food only for birds that live near the equator, where night is never longer than day. Only an insectivorous hummingbird, with crop well filled with insects, can withstand the long winter nights of the temperate zones when the temperature is below freezing. I have observed that captive hummingbirds fed on the honey solution were unable to survive 14 or 15 hours without food.

Insect and Other Animal Food

Most Mexican hummingbirds feed chiefly on insects, spiders, and other small animal life, but there is great variation in their methods of procuring such food. The method is largely determined by environmental conditions, though it also varies in part with the individual species. The prey may be extracted from tubular flowers, picked off from shallow flowers, captured in the air, or taken from crevices in bark, from young shoots, withered leaves, spider webs, fresh fruits that have burst open, and even from the surface of water.

Flowers as a source of food. Whenever possible most species procure their animal food from flowers. When flowers furnish abundant insects, hummingbirds only occasionally hunt them elsewhere.

The exact method of procuring insects from tubular flowers is unknown. Probably the tongue, thrust into the flower, gropes about until an insect adheres to it. The various shapes of tubular flowers are significant in relation to the birds' visits to them. When different types of such flowers bloom simultaneously at the same place, each is usually visited by a different species of hummingbird. In the mountains surrounding the Valle de Mexico, one finds at many spots in August and September the White-eared Hummingbird (*Hylocharis l. leucotis*) at *Salvia mexicana* and *S. polystachya,* the Mexican Violet-ear (*Colibri t. thalassinus*) at *Salvia mexicana* and *S. cardinalis,* while the Blue-throated Hummingbird (*Lampornis clemenciae*) visits only *S. cardinalis.* Convenience is apparently the determining factor. Each species visits the flower from which it can most easily obtain insects or nectar with its peculiar shape of bill. The calyces of *Salvia cardinalis* are too

deep for the White-ear, and those of *S. mexicana* are so small that it is not easy for the large-billed Blue-throated Hummingbird to obtain food from them (although observations have shown that it is possible).

Many species choose shallow flowers when these are available, and the shape of the bill is then not a factor; I have seen species with long straight bills, short and thin bills, and even more or less curved bills, visit the same blossoms.

I have found no evidence for the theory that the long curved bill is a specific adaptation for feeding from certain species of flowers. In fact, not a single species of Mexican hummingbird is adapted to a specific shape of flower. This is not to say that the peculiar bill shapes did not originate as special adaptations during evolutionary development in a different environment. But probably such specialization is not possible in northern latitudes with their extreme climatic changes.

The theory that flowers of a certain color have a particular attraction for hummingbirds has often been discussed. Although the point is not a difficult one to settle by experiment, and observations by Woods (1927:306–307), Sherman (1913), and others seemed to contradict the theory, Bené (1941) was the first to prove conclusively that an innate preference for red does not exist in hummingbirds.

In the summer and fall of 1941, I conducted an investigation similar to Bené's. In a spot frequented by many hummingbirds, I hung several feeding flasks of the usual type covered with paper of different colors. At intervals of 30 minutes to an hour I measured the amount of syrup taken from each flask, in order to determine the comparative frequency of visits to the various colors. I found that the flask most frequently visited was always of the same color as the flower most visited at that particular season. It was purple in July when the purple *Pentstemon campanulata* was in full bloom and was visited by hummingbirds almost to the exclusion of other flowers. In October, when the dark blue *Salvia mexicana* was in bloom, the liquid in the dark blue flask was almost entirely used up, while the purple flasks that had been favored in July were frequently left full and untouched. Further evidence was the observation that, at a given place and time, each species of hummingbird would choose the flask of the color that corresponded with the color of its preferred flower then in bloom. Thus, in season, the Mexican Violet-ear showed a preference for red flasks, in accordance with its preference for the red flowers of *Salvia cardinalis;* while the White-ear, which visited the blue flowers of *S. mexicana* almost exclusively, patronized the blue flasks almost exclusively.

Summarizing his results, Bené says (p. 242): "Color preference may be conditioned by training, as when a hummingbird trained to feed on a colorless syrup remains constant to it, even when the colorless syrup is placed among feeders containing syrup of different colors." It appears that the same conditioning to a given color (varying with the species, the locality, and the season) occurs under natural conditions when a flower of that color provides particularly abundant food.

Hawking insects. The capture of insects by hummingbirds in flight is frequently doubted or else considered an exceptional phenomenon (e.g. Moller, 1930: 677). But I have often observed Mexican hummingbirds capturing insects in the air, and this means of procuring food is essential to some species at certain seasons.

Skill in capturing insects in the air, as well as the method employed, varies from species to species. The technique of capture used by a number of species is described in the following pages and illustrated in Figures 2 to 9. In each drawing, arrows indicate the direction of flight; a dot in the path of flight indicates that the bird hovered at that spot for a certain length of time.

Species that regularly capture insects in the air hover at a given spot and then suddenly dart forward about a meter's distance to seize an insect. Presumably the bird must be at a certain distance from the prey in order to see it and instantly dart upon it with accurate aim. How the bird seizes the insect is difficult to determine since the movement usually takes place too rapidly and at too great a distance from the observer to be accurately followed by the eye. I once observed under favorable conditions, and from quite near by, a Deville's Hummingbird (*Amazilia beryllina devillei*) capturing insects. This hummingbird did not make its capture by using the bill but by darting out the tongue for a fraction of a second so that the insect was caught upon it. Occasionally I saw the bill open to a 15- or 20-degree angle, but this seemed to occur after a successful attack, when the insect adhering to the tongue needed to be moved to the back of the bill.

Deville's Hummingbirds and Pale-crowned Star-throats (*Heliomaster longirostris pallidiceps*) spend the month of April in the gallery forests near Villa Flores in the dry areas of interior Chiapas, where the water level is very low at this season. Innumerable dipterous larvae develop in the many stagnant pools of the drying stream beds, and the insects dance morning and evening in thick swarms.

Deville's Hummingbirds were numerous at these spots and fed chiefly on insects caught in the air though I occasionally saw one hovering at the inconspicuous flowers of a Chalu tree (*Inga* sp.). They would perch on a small twig, some 8 to 15 meters above the ground, at a spot near a dancing swarm of insects, and from there make attacks on the swarm at intervals of three to five minutes (Figure 2). The bird approached the swarm by direct flight, hovered for an instant beneath it, then attacked an insect by darting obliquely upward. Whether the bird captured the prey or the insect escaped could not be determined from a distance, but the bird would hover at the spot for an instant and then attack anew in the same manner. After several flights directed obliquely upward (three to five, depending on the size of the swarm), the bird would reach a point above the insects, hover there for two to four seconds, then return to a point underneath the swarm and again dart upward through it capturing insects. Occasionally I observed two in-

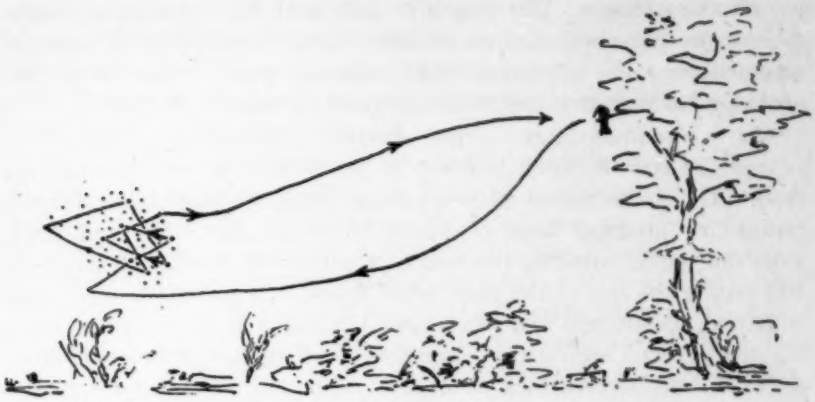

Figure 2. Deville's Hummingbird capturing flying insects.

dividuals of this species hunting alternately through the same swarm.

I have only occasionally observed insect-hawking by Pale-crowned Star-throats, which rarely appeared in my observation area. Like the Deville's Hummingbird, they use a look-out post to which they return after each series of captures. The bird flies out to the swarm of insects and remains for a few seconds beneath it to aim for the first victim (Figure 3). After each attack the bird hovers for an instant to take aim for the next insect. The method of capture is essentially the same as in Deville's Hummingbird, but the individual attacks are less sudden and swift and the line of flight curved. When the bird has reached the highest diptera, it returns in gliding flight to a spot beneath the swarm and again proceeds upward. When it has hunted through the swarm from three to five times, it returns to the look-out post on a

Figure 3. Pale-crowned Star-throat capturing flying insects.

curved line of flight. The length of each period of hunting probably depends on the number of successful attacks. In this species, also, I repeatedly saw the bill opened widely after an attack on an insect; this probably has no connection with the actual capture of the prey.

As a non-migratory forest dweller, De Lattre's Sabre-wing (*Campylopterus h. hemileucurus*) is dependent on locally available food. During the season when a certain ornithophilous flower (*Marcgravia* sp.) produces large quantities of nectar, the Sabre-wing feeds from this, either drinking the nectar or eating the insects caught in it. But during the rest of the year, when flowers are scarce, its chief food is animal, as stomach analyses show. I watched a Sabre-wing capturing gnats from a swarm that danced over a large forest brook (Figure 4). The bird hovered at a distance of 50 to 100 cm. from the swarm

Figure 4. De Lattre's Sabre-wing capturing insects from a swarm over a forest stream.

and then suddenly darted straight forward. It hovered a moment in the midst of the swarm, then flew back to its starting point. After some six or eight such sorties, it disappeared into the neighboring woods. Several times I saw what was probably the same individual capturing insects at the same place.

The Rieffer's Hummingbirds (*Amazilia t. tzacatl*) that occupied the garden of my house in Chiapas used the same method of capture. However, they also hunted assiduously in the blossoming orange trees, whose fragrance attracted countless insects. Blossoming plants were rare at the time of my observation (January and February) outside this small cultivated area, and hence another means of procuring food was necessary. With this species the habit of hawking insects was apparently so firmly fixed that they hawked—at least at this season—even where blossoming plants were plentiful.

In contrast with the species discussed above, there are some that wait on a perch until an insect comes within aiming distance. Heloise's Hummingbird hunts its prey in this fashion, darting out at an insect when it approaches within a meter or a meter and a half. The bird pauses for a fraction of a second at the spot where the insect has been caught. Usually it does not return to the same perch but goes to one near by. In the instance pictured in Figure 5, a female Heloise's Hummingbird perched again and again on the outermost tips of maguey (*Agave*) leaves. At the edge of a field bordered with maguey plants, several hummingbirds were busy capturing insects at the same time, each maintaining its own territory. Feeding conditions were favorable here because the larvae of the insects, a species of minute fly, developed in countless numbers in the damp mouldering stalks of the maguey plants destroyed by the pulque makers.

In the same group were also White-ears, which live in the high mountains of central Mexico and are among the few hummingbirds that remain (at least in part) in the breeding range even during the non-breeding season. To survive the food scarcity of winter (when the temperature is sometimes as low as 15° F.), as well as the hot rainless season from March to May, they must employ every possible method of procuring food. During much of the year, this species "gathers" almost all of its animal food, for the organisms that form its prey are mostly sedentary in cold and inclement weather. But occasionally it

Figure 5. Heloise's Hummingbird capturing single insects along a field border.

catches insects in the air—which it is able to do with great dexterity. It waits on a perch until an insect approaches within 30 or 40 cm., then suddenly pounces upon the prey, hovers for a moment, and returns to the same perch or, exceptionally, to one near by. Very rarely—apparently after missing its prey—it makes a second attack from closer range. The attempts at capture occur at intervals whose length apparently depends on how often an insect comes near the bird. Occasionally they occur in quick succession, as I have observed when a White-ear was perched near a swarm of gnats dancing in the sun. It would remain only two to four seconds on the perch before aiming at new prey.

Besides the habitual insect hawkers noted above, I observed a number of occasional hawkers—so described not only because I rarely observed them hawking, but also because their technique (as shown by the frequency of unsuccessful attempts) was less well developed.

To this group belongs the Mexican Violet-ear, which is very common in late summer in the mountains surrounding the Valle de Mexico. It obtains its food mainly from flowers, and most individuals of the species migrate as soon as flowers in the high mountains begin to diminish in fall. A few males remain for the winter in especially favorable localities (Wagner, 1945:166), but even these feed chiefly in the sparse *Salvia cardinalis, S. elegans,* and *Calamintha macrostema,* which in sheltered places do not freeze. Rarely, however, I have observed a Violet-ear awkwardly catching insects in the air. On one occasion, when the conditions for observation were extremely good, the hunting took place from a perch in an oak sapling. Near the tree danced a small swarm of gnats in which my eye could follow the movements of individuals. Again and again I saw the hummingbird miss a gnat for which it had aimed or a gnat evade capture at the last moment. The Violet-ear perched on the outermost tip of a twig and waited until an insect approached, then took aim and darted forward—usually with negative results. Before returning to its perch, the bird usually made several attempts at capture, hovering momentarily each time to take aim at the nearest insect. Several such sorties are shown in Figure 6.

The Broad-tailed Hummingbird (*Selasphorus p. platycercus*), which is common in the Valle de Mexico, especially in late summer, has still another technique. I have on a number of occasions watched this bird catching insects from a perch on the tip of a corn stalk. Apparently seeing an insect, the Broad-tail would fly to a point some three to five meters away, then turn sharply, and suddenly begin darting back and forth, hovering for an instant before each change of direction (Figure 7). After several such attempts to capture one insect (whether with or without success did not appear), the Broad-tail would suddenly dart after another that came in sight a few meters away. It repeated this a few times before returning to its perch on the corn stalk. This occurred at a season (August and September) when there was no lack of

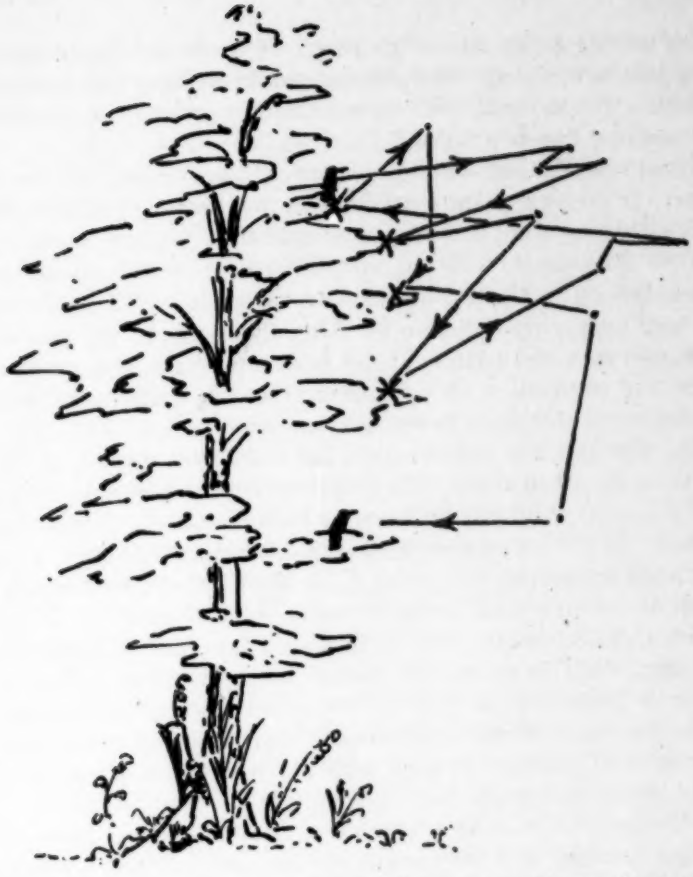

Figure 6. Mexican Violet-ear capturing flying insects that pass its perch.

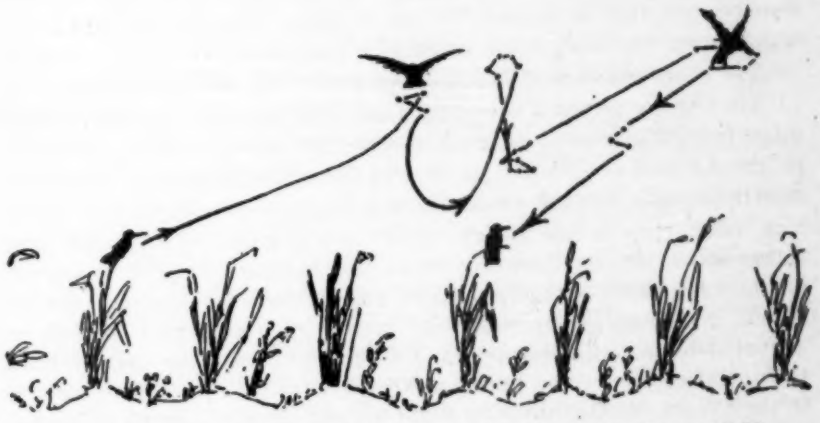

Figure 7. Broad-tailed Hummingbird capturing insects above a cornfield.

flowers holding a rich medley of insects. I never saw Broad-tails capturing insects in the air when feeding conditions were unfavorable; instead they always "gathered" them. And I consider these instances of their hawking merely a form of play.

Rivoli's Hummingbirds occasionally capture insects in the same manner. In contrast to the quick, darting flight of other species, that of Rivoli's Hummingbird is slow, almost deliberate. In the spring, in the Valle de Mexico, I observed Rivoli's Hummingbird attacking the diptera dancing in the sun a few meters from its perch in the top of an oak or pepper tree (Figure 8). After flying out to the insects, the bird moved back and forth in almost horizontal flight, attacking insects at ranges of 20 to 40 cm. It is amazing to see this species turn from one direction to another while hovering at one spot.

The Blue-throated Hummingbird has a different method of capture from those described above. The bird darts here and there to the points where it sees its prey, without hovering even an instant when it changes direction. In the mountains, early one morning in October, I saw a Blue-throat attempting to capture a few flying insects from a perch in the top of a spruce some 20 or 25 meters high (Figure 9). The bird was not a skillful hunter, and it zig-zagged back and forth again and again, apparently in an attempt to capture a single insect. When the weather is inclement and flowers scarce after this hummingbird arrives in the high mountains in spring, it obtains the necessary food by gathering small animal life from bark and vegetation; capture of insects in the air is of minor importance to the species.

Collecting food from bark, vegetation, spider webs, and fruit. When gathering animal food from various surfaces and crevices, a hummingbird first sees the prey, hovers to take aim, then suddenly pounces. The importance of this "gathering" method varies greatly, from species such as Abeillé's Hummingbird (*Abeillia abeillei*), which takes only an occasional insect that it happens to see, to those such as the White-ear, which hunts its food almost entirely in this manner.

The short bill of Abeillé's Hummingbird (measuring between 9 and 11 mm.) is less suited to obtaining food from flowers than that of most other hummingbirds. I have often observed the species in the humid primeval forest of Chiapas; it lives in the half-darkness of the undergrowth beneath the tall thick-crowned forest trees and is very rarely seen more than a few meters above the ground. Only a few and rather inconspicuous flowers grow in this habitat. In May the arum plants (Araceae), with their large, thickly-flowered spadices, are in bloom, and Abeillé's Hummingbird is then seen gathering the insects attracted to these flowers by their fragrance. But they usually hunt their food on leaves and young shoots. I have also seen them moving in their characteristic hovering flight up and down the trunk of a tree, stopping suddenly to pick an insect from a crevice, from moss, or from

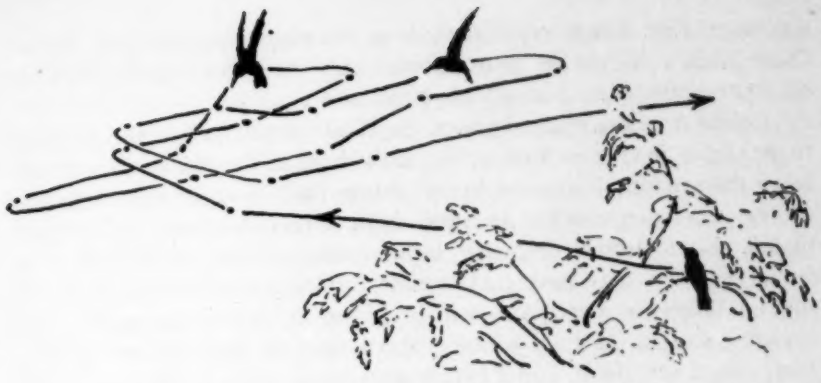

Figure 8. Rivoli's Hummingbird capturing diptera near its look-out in a treetop.

Figure 9. Blue-throated Hummingbird capturing flying insects.

a smooth stem. Microscopic analysis of the stomach contents of two of these birds collected in May showed only fine insect pulp with no admixture whatever of vegetable substance.

Unlike Abeillé's Hummingbird, the White-ear has a bill well adapted to procuring food from flowers, but individuals of the species that do not leave their mountain habitat in fall obtain their food for seven months of the year from crevices in bark, from withered leaves, and similar places. Sleet storms, or heavy snows, which occur occasionally and cover the prey, may have catastrophic results. Only a fraction of the normal White-ear population will be found in such areas in the next breeding season. In mild winters, plants such as *Euphaterium glabratum, Stevia salicifolia,* and *Physalis acuminata* begin to bloom in well-protected spots as early as January, and where these are available, the White-ear obtains the greater part of its insect food from their minute flowers. In spring, the new green spruce shoots are a productive source of food. A small species of aphid (plant louse) is then found in great abundance among the needles and attracts this and other species of hummingbirds. I also once watched a male White-ear picking around in a spider's nest where the young were hibernating. The disturbed young spiders ran in all directions from the nest and were captured one by one.

In May, when the Blue-throated Hummingbird returns to its breeding range in the vicinity of the Capital, no flowers are in bloom, for the rains have not yet begun. The species then resorts to the new green spruce shoots to find its food. In a few places *Salvia elegans* and *Bouvardia ternifolia* grow under the trees, but the hummingbirds do not visit them, apparently because they are a much less productive source of food during the drought than spruce shoots. Examination of 50 blossoms from these plants yielded only three insects, two of them very small.

In the high mountain rain forest of Chiapas, the Guatemalan Cazique (*Lampornis amethystinus salvini*) hovers at thick moss-covered tree trunks looking for small animal prey. For some time it rises and sinks in hovering flight for a distance of about 30 cm. along the trunk, then suddenly stops for an instant and quickly projects its tongue to capture the prey. The next instant the bird is rising and sinking again in steady quiet flight at a place farther along the same trunk. In the spruce woods near the Capital, I observed another race of this species, *Lampornis a. amethystinus*. Usually it fed at flowers, but occasionally I saw it hunting along tree trunks.

During the dry season Rieffer's Hummingbirds occasionally come to the coffee plantations. They hunt over the young coffee shoots for small animal organisms and gather the insects caught in spider webs among the twigs. Near Mexico City I noticed a female Elliot's Hummingbird (*Atthis heloisa ellioti*) in July eagerly hunting food among spruce shoots. Since at this season there was no lack of flowers there, I assumed that the bird was hunting spiders for its young.

Some Broad-tailed Hummingbirds breed in the neighborhood of the Capital from the end of September through November. The breeding territories are frequently in the Petregal lava fields, which have a luxuriant vegetation during the rainy season. At the time of the birds' arrival everything is in full bloom. But in many years the dry season begins so early that when the young are developing and require abundant nourishment, the greater part of the flowers are already withered. At such times I saw the females seeking food among dry shrubs and foliage. The numerous males go elsewhere (exactly where is unknown) as soon as feeding conditions become unfavorable, whereas the females are held to the spot until their young are independent and can leave with them.

On several successive days I observed Prevost's Mangos feeding at the dried out, open fruit husks of a certain tree. They hovered about the bare branches, stopping at the old husks, apparently feeding on various small animal organisms.

Ripe fruit is also occasionally a source of insect food. Thus in May, in Teotitlan, Oaxaca, I regularly observed Dusky Hummingbirds (*Cynanthus sordidus*) at the burst open fruits of the candelabrum cactus (*Cephalocereus*). Stomach analysis proved that the birds consumed only animal food, disregarding the sweet watery pulp of the fruit. I had supposed that this juice was taken like nectar, since the feathers about the base of the bill were sticky with the substance.

In the coffee plantations, open stands of Chalu trees (*Inga* sp.) are cultivated as shade trees, and these are in bloom for a week or two in March. The small pale green flowers are far less conspicuous than pear blossoms but resemble them in structure. With a twig in the hand, one can readily see the great numbers of insects that crawl about the blossoms. When these trees are in bloom, hundreds of hummingbirds visit the coffee plantations, which at other times are visited by only an occasional individual. I have estimated 10 to 15 hummingbirds to a thousand square meters. They stream in from all directions, the radial distance depending on the type of terrain but estimated to extend up to 20 kilometers. They gather during the first week of the blossoming in constantly increasing numbers from the surrounding forest, from the oak-pine forest lower down, and from the savanna, which at this season is quite parched and dry. I have watched the following species collecting insects at these trees: De Lattre's Sabre-wing; White-bellied Emerald (*Amazilia candida*); Deville's Hummingbird—in numbers; Red-billed Azure-crown (*Amazilia c. cyanocephala*)—in great numbers; Pine Starthroat (*Heliomaster constantii leocadiae*); Dupont's Hummingbird (*Tilmatura dupontii*)—in numbers; and Dusky Hummingbird. As soon as the blossoms fall, the birds disappear.

Capturing insects from the surface of water. I have only once observed a hummingbird capturing insects from the surface of water. I was unable to identify the bird positively, but it was probably a Red-

billed Azure-crown, which at that place was very common. (Anyone who has done field work in the Tropics knows how difficult identification is when there is no distinctive peculiarity of pattern or form. The light usually makes color recognition impossible.) The bird appeared suddenly and hovered some 50 cm. above a quiet spot in a mountain stream. At intervals of 5 to 20 seconds, the bird darted upon the small aquatic hemiptera (*Rhagovelia* sp.) moving along the surface of the water. The bird hovered there for a brief instant and rose again. After three to six of these attempts it would disappear for a few minutes in a tangle of vegetation, then return to resume its hunting.

Composition of animal food. The animal food consumed by hummingbirds includes all sorts of small organisms, size, apparently, being the only limitation—bugs, flies, gnats, and plant lice, mosquitoes, leaf hoppers, ants, parasitic wasps, beetles, weevils, spiders, daddy-long-legs, as well as other organisms, have been found in analyses of stomach contents (Wetmore, 1916:70–73; Cottam and Knappen, 1939:160–162; Beal and McAtee, 1922:13–15). I have found that diptera often constitute the major portion of the diet of hummingbirds. This is not necessarily because the hummingbirds have a preference for them; the habits of the diptera may make them easy prey. In some species, as shown by crop analysis, spiders constitute a large proportion of the food given to the young during the first weeks.

It is surprising how large an insect a hummingbird can swallow. Mosquitoes of the genera *Anopheles* and *Culex,* which are quite bulky, were captured in flight and apparently swallowed whole. The largest prey that I have found intact in the crop of a White-eared Hummingbird was a spider of the genus *Neosconella.* The total length was 4.8 mm.; the body diameter, 2.6 mm. In the crop of a Blue-throated Hummingbird, which is larger than the White-ear, I found, in addition to many large diptera, a spider of the genus *Metepeira* 5.4 mm. long.

Formation of pellets. I have twice found pellets (consisting of chitin) in the stomachs of hummingbirds. Fine pieces of chitin are ground by ordinary stomach action and excreted through the intestine, as analysis of feces shows. But pieces of chitin too large and hard for digestion are apparently regurgitated in the form of pellets. I found both pellets in March, when the drought was most severe and the species I encountered were feeding entirely on animal prey. A specimen of the Red-billed Azure-crown had in its stomach a round pellet, 4 mm. in diameter, made up entirely of coarse pieces of chitin pressed tightly together. The other pellet, found in a specimen of the Pine Star-throat, was the same size, but rather more oval in shape. Wetmore (1916:73) says that Green Mangos (*Anthracothorax viridis*) "undoubtedly regurgitate waste matter, in the form of pellets, from which the nutriment has been digested. Several of these, 2 millimeters long by 1 wide, ready to be expelled, were found on opening the stomachs, and in each case consisted of a firmly compressed pellet containing chitinous fragments of insects and spiders."

Drinking and Bathing

Hummingbirds drink and bathe far more often than is generally supposed. When nectar is abundant, they doubtless have little need of water to quench their thirst—which would explain why they are rarely seen drinking except during the dry season, when they are feeding on insects.

In the vicinity of the Capital in winter and spring, I regularly saw White-ears drinking and bathing in a forest stream. At the foot of a small gorge, there was, during the latter half of the rainy season, a waterfall with a drop of some five meters over rocks; this, during the dry season, became a mere trickle of water. The White-ear would hover near the tiny fall and plunge its tongue into the water. After drinking several times in this manner, the bird would disappear unless a bath was to follow. This is the simplest and easiest method of drinking but not always possible, and the White-ear employs others. It will hover close above the surface of a stream, then suddenly plunge downward, rising again immediately. Thus, for an instant, either the bill or the tongue is dipped. The White-ear also drinks when it has settled in shallow water to bathe; then only the tongue is dipped. Elliot's Hummingbird quenched its thirst in a similar way (Figure 10), but it remained hovering close above the water for a longer time and from that position dipped its tongue or bill, causing each time a tiny ring to appear on the water.

When bathing at the waterfall described above, the White-ears would hover beneath a spot where the water fell drop by drop and thus in a minute or two become quite wet. They would then perch on a

Figure 10. Elliot's Hummingbird drinking.

sunny twig, spread their wings and tail, and preen and arrange their feathers as they dried in the sun. A female Blue-throated Hummingbird that was building a nest in the gorge bathed in the same fashion. Three times in one morning she bathed, preened, and arranged her feathers—apparently because she frequently gathered nest material from steep overhanging slopes and trunks, and her plumage was soiled by the dust and dirt she dislodged.

White-ears also bathe at shallow spots in small streams, alighting in the water and splashing their feathers. Rising from the water again seems to cause them no difficulty. Some mornings after the sun was up I would see two or three hummingbirds bathing and drinking together. C. C. Lamb (1925:90) observed nine Xantus Hummingbirds (*Hylocharis xantusii*) bathing at the same time. They would sit in the water and splash themselves with their wings, then fly into a tiny waterfall near by. I twice surprised several Red-billed Azure-crowns bathing early in the morning at a curve in a small stream where the water was shallow and the shore sandy. They seemed to be familiar with the spot, for they alighted in the flowing water without hesitation.

One of the White-ears that I held captive would bathe at once when in the mornings I put a saucer of water in the cage. Its cage mates (of the same species) paid no attention to the water—perhaps because they were liberally sprinkled with water while the other was bathing. I have never observed hummingbirds drinking dew drops or flying through wet leaves to dampen their feathers (see, for example, Woods, 1927:307; Skutch, 1931:482).

Cross-pollination by Hummingbirds

The importance of hummingbirds to pollination of flowers is far greater in tropical South America than in Mexico. Since hummingbirds probably immigrated to Mexico in relatively recent times, it is understandable that there are very few ornithophilous plants * in Mexico compared with the abundance there of plants primarily adapted to pollination by insects. The ornithophilous plants of Mexico are without exception also immigrants from tropical South America.

The Marcgravia group of ornithophiles has a wide range in the tropical belt of the continent. Southern Mexico is the northernmost limit of their range, and only two species are known from there: *Marcgravia mexicana* and an unnamed species discovered by F. Miranda in northern Oaxaca, shown in Figure 11. The Marcgraviae are epiphytic, a character that limits them to the rain forest where the humidity is high. They thrive on more or less horizontal branches in the crowns of the forest trees. The flower of the Mexican species is a chandelier-like inflorescence with the fertile blossoms—numbering 120 to 150—arranged

* In my opinion, the term 'ornithophilous' is correctly applied only to flowers that are phylogenetically adapted to pollination by hummingbirds, not to those originally adapted to pollination by insects and whose evolutionary development is in no way correlated with birds.

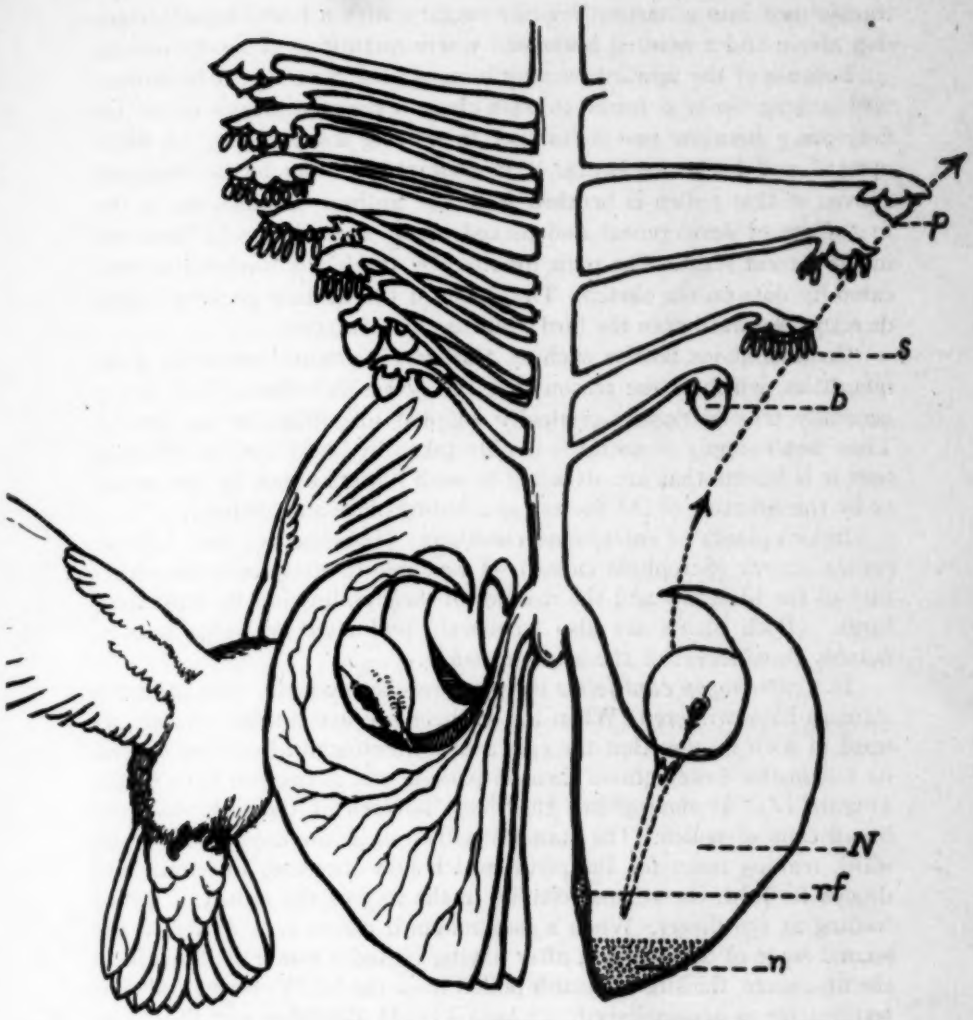

Figure 11. Hummingbird feeding at a flower (*Marcgravia* sp.). *After* F. Miranda. p = pistil; s = stigma; b = bud; N = nectary; rf = rudimentary flower; n = nectar.

on long thick stalks (pedicels) about the upper part of the hanging main axis (rachis). These blossoms face downward at right angles to their pedicels, which, in turn, are arranged at right angles to the rachis. These fertile blossoms are protandrous, that is, in each blossom the pollen-bearing anthers develop first, the stigmas later. The blossoms at the lower tip of the hanging inflorescence (morphologically speaking, the *upper* flowers) are abortive; the pedicel and bract of each are

transformed into a narrow bag-like nectary with a horn-shaped extension above and a pointed lower end where quantities of honey collect.

Because of the upward curving horns of the nectaries, a hummingbird seeking honey is forced to push close to the central axis of the inflorescence between two nectaries. In moving away again, its flight upward and backward brings it in contact with the fertile blossoms above, so that pollen is brushed from the anthers of blossoms in the first stage of development and picked up by the stigmas of blossoms in the second stage. The path followed by the bird's forehead is indicated by dots on the sketch. The shape of the nectary prevents flight directly backward once the bird's bill has been inserted.

Ornithophilous flowers such as *Marcgravia* produce nectar in great quantities, which is the reason that the flower is visited. This is not generally true of flowers originally adapted to pollination by insects. Their small supply of nectar is readily taken by birds, but for the most part it is insects that are attracted to such flowers either by the nectar or by the structure of the flower (as a hiding place and shelter).

In two plants—*Centropogon cordifolius* (Lobeliaceae) and *Lamourouxia exserta* (Scrophulariaceae)—I was able to study both the structure of the blossoms and the manner of their pollination by hummingbirds. (Both plants are also frequently pollinated by large insects, notably bumblebees of the genus *Bombus*.)

In *Centropogon cordifolius* the pistil reaches maturity only after the stamens have withered. When the stamens are mature they droop forward in such fashion that the crown of a hummingbird coming to sink its bill in the flower grazes them in passing and is covered with pollen (Figure 12). Hummingbirds that have hovered at these shrubs wear broad caps of pollen. The stamens wither in a few days and tilt upward, making room for the pistil, which now increases in length and droops forward, the stigmas coming in the way of the crown of a bird feeding at the flower. When a hummingbird comes to a flower in the second stage of development after having visited a flower that is still in the first stage, the stigmas brush pollen from the bird's crown, and thus fertilization is accomplished. Pickens (1927) describes and illustrates the pollination by the Ruby-throated Hummingbird (*Archilochus colubris*) of a flower (*Macranthera LeContei*) that has similar stages of development.

Centropogon cordifolius produces only a small quantity of nectar. Insects and other small animal organisms come to the blossoms less for the nectar than for shelter from inclement weather. Mornings before the sun begins to shine there are four times as many insects and other small organisms in such shrubs than later when it becomes warmer—which explains the large number of birds attracted during the early part of the day.

In the mountains near the Capital, above 3,000 meters, my interest was aroused by several Violet-eared Hummingbirds with crowns yellow

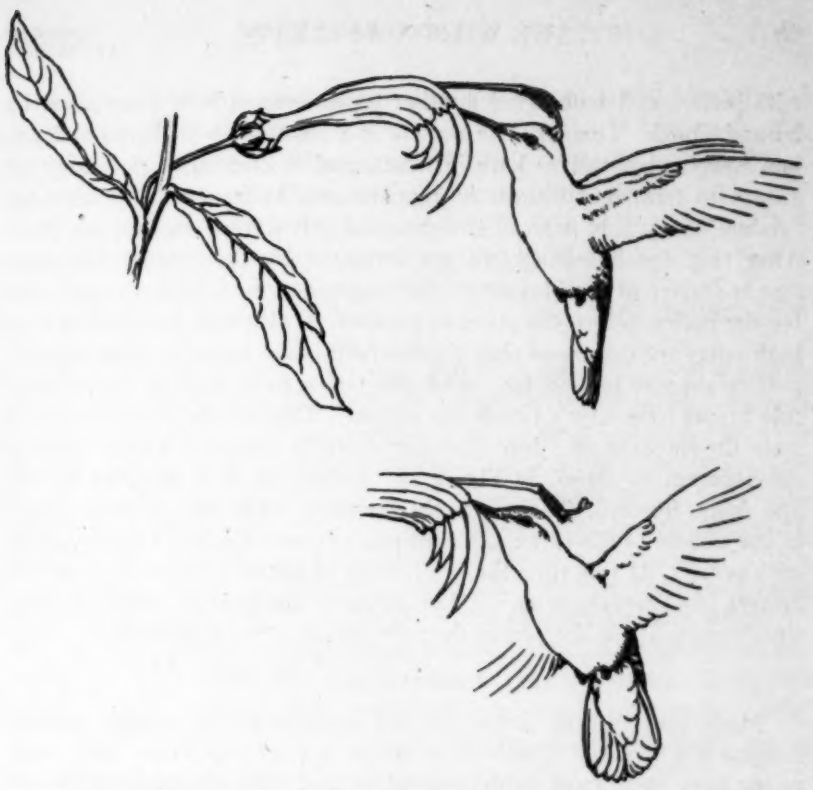

Figure 12. Hummingbird feeding at *Centropogon cordifolius*. *Upper*. During the first stage of the flower's development, when the bird's crown brushes the pollen-bearing anthers. *Lower*. During the second stage of the flower's development, when the stamens have withered and the bird's pollen-covered crown brushes against the stigmas.

Figure 13. Hummingbird feeding at *Lamourouxia exserta*. The tuft of stigmas brushes the flower's own pollen, or pollen brought from another flower, from the bird's forehead. In the flower shown here, the stamen is not fully developed, and only cross-pollination can occur.

with pollen, and I observed another typical example of pollination by hummingbirds. *Lamourouxia exserta* is a small bush with red and yellow flowers that thrives both in woods and in clearings. It is very resistant to frost and blooms in January and February. The nectaries produce honey only in small amounts and only during the first few days. After that the hummingbirds are attracted by the insects that have sought shelter in the blossoms. The stigmas of each blossom are ready for the pollen before the stamens produce it, although for a short time both parts are mature so that if cross-pollination has not occurred, self-pollination may be possible. When the petals have opened, a small capsule bursts, releasing a brush-like stigma. This tuft brushes the pollen from the forehead of a bird that has visited a flower in a later stage of development as shown in Figure 13. Later, the four stamens mature and droop forward. The stigma then withers, while the stamens remain in the middle of the calyx and continue to cover visiting hummingbirds with pollen. At this time the production of nectar ceases. Neither the flowers of *Centropogon* nor of *Lamourouxia* are strictly ornithophilous, since insects are in both cases the primary agents of pollination.

Conclusions

Many investigators of the bill and anatomy of the tongue of hummingbirds are of the opinion that nectar is the birds' chief food. But, as we have seen, most field observation and stomach analyses do not support this opinion.

Granted that flower visiting, with its associated consumption of nectar and small insects, is the favored mode of feeding, it is not a vital factor for the majority of Mexican species. With them, on the contrary, the vital factors in the struggle for existence are frequently the capture of insects on the wing and the various methods of "gathering" insects.

Phylogenetically the shape of the bill is presumably an adaptation to the extraction of small animal life from tubular flowers. (The ontogeny of the bill, tongue, and stomach anatomy, as well as the food given the young during the first weeks, shows that the original food was animal.) I imagine that the taking of nectar and the correlated transformation of the tongue first began when the form of the bill had become so modified that it easily reached the nectar in the flowers. Then, with the progressive development of the tongue as a pump, nectar became more important as a food. The bird's preference for nectar is not surprising. If a captive bird is given the choice between sweetened water and pure water, it uses the sweetened, and the amount of liquid taken by the bird daily is greatly increased.

In connection with food we can distinguish three stages in hummingbird phylogeny:

1. Insect food as the chief item of diet
   a) Captured in flight with a broader bill—indicated by the

morphology of the young and the hummingbirds' relationship to the swifts.

b) Extracted from flowers with a bill becoming progressively longer as it adapts itself to this mode of feeding.

2. Nectar as the chief item of diet
The tongue develops into a highly specialized pump.

3. Return by a certain number of species to insects as major item of diet

The third stage is contemporary. We are familiar today with all the transitions, from birds that feed chiefly on nectar to birds that feed almost exclusively on insects. There is no evidence so far of any morphological adaptation to the renewed preference for animal food, but this is not surprising, since it is a well-known phenomenon of biology that when an organ has reached a high degree of specialization it seems to have less plasticity for radical transformation.

The fact that hummingbirds hover while procuring their food, even when capturing insects in the air, is also significant. I have never observed them catching insects in the manner of swifts, swallows, or flycatchers. This fundamental difference in method of insect capture indicates that hummingbirds developed their present method after they had in the course of their evolution become adapted to other modes of feeding.

There remains the question of what made the change in feeding habits necessary. The family Trochilidae originated in tropical South America, perhaps late in the Cretaceous or in the early Tertiary—at any rate, at a period of exceptionally stable tropical climate (Mayr, 1946). This permitted an adaptation to a diet consisting largely of nectar, and not subject to shortage caused by the pronounced flowering seasons that characterize all temperate, and even subtropical, regions. The deterioration of the climate in the latter part of the Tertiary, and the development of pronounced seasons nearly everywhere except in a small portion of the tropics, favored a return to a greater utilization of insects. This was particularly true for the species that had colonized subtropical and temperate zones, where nectar food was not available at all seasons. Such species either became migratory or adapted themselves to a seasonal diet of insects.

Summary

Observations were made on 19 species of Mexican hummingbirds to determine the composition of their food, techniques of procuring food, manner of drinking and bathing, and method of pollinating ornithophilous flowers.

The food of hummingbirds is determined by the ecological conditions under which the individual species live. Every degree of dif-

ference occurs between feeding, at least temporarily, exclusively on animal food to feeding temporarily exclusively on nectar.

In areas with pronounced dry seasons, in the high mountains, and in the temperate zones, a medley of small animal organisms constitutes the principal food. In many of these regions the birds migrate at seasons of unfavorable feeding conditions. In tropical habitats, nectar predominates in the food.

Under natural conditions, hummingbirds are conditioned to the color (varying with the species, and with locality and season) that corresponds with the color of the flower that is the most productive source of food.

As long as nectar from flowers is available, it is the preferred food. When the supply of nectar is inadequate, insects are eaten, preferably from flowers, but when these are insufficient, hummingbirds are forced to feed on insects gathered from other vegetation and from crevices, or captured in flight.

Hummingbirds feed while on the wing whether they are extracting nectar or insects from flowers, gathering insects from the vegetation, or capturing flying insects.

The method of capturing insects in flight varies from species to species.

The animal food consumed by hummingbirds includes all sorts of small organisms, size, apparently, being the only limitation.

Pellets are formed of the larger pieces of chitin and regurgitated.

Hummingbirds drink and bathe far more often than is generally supposed.

Two flowers especially adapted to pollination by hummingbirds occur in Mexico (*Marcgravia* sp. and *Marcgravia mexicana*). Both hummingbirds and ornithophilous plants are tropical in origin, having spread in recent times into Mexico from the south. In many cases where pollination by hummingbirds occurs, pollination by insects is also possible.

Hummingbirds were originally insectivorous. At a later stage of development, nectar became their principal food. Paralleling this change, the tongue developed as a suction pump. With the general deterioration of climate in the latter part of the Tertiary and the colonization by hummingbirds of the subtropical and temperate zones, certain species were forced to return to a greater utilization of insects as food.

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SPECIATION IN THE WHITE-CHEEKED GEESE *

BY JOHN W. ALDRICH

IN an attempt to identify certain specimens of white-cheeked geese from various parts of the United States it was necessary to review all of the forms, using the specimens in the United States National Museum and others, borrowed from various collections, totaling 254 birds.† With a few exceptions the results of the study bore out the conclusions of Taverner (1931) and Todd (1938). The results reported here are for the most part supplementary, rather than contradictory, to their findings.

Variation trends.—When specimens of white-cheeked geese are arranged by color and size, the following geographic trends are noticeable: increasing size from north to south; and increasing darkness from east to west, except in the more southern regions of the breeding range, where the geese show the pallor usual in arid plains and basin country. In other words, the smallest geese are those that breed on the Arctic tundra, the largest those that dwell in the more southern, forest and grassland, regions; pale geese breed in the Atlantic maritime region, while darker geese occur in the interior, from Minnesota north to Hudson Bay, where the trend is reversed, so that the palest of all white-cheeked geese are found in the plains and basin country from Lake Athabaska southward, and west to Utah and eastern California, Oregon, and Washington, with then a rather abrupt change to the darkest white-cheeked geese breeding on the Pacific coastal strip of western and southern Alaska and British Columbia.

Speciation.—On the surface, such trends look like normal subspecific variation. However, naturalists and Eskimos alike have observed sharp differences in the behavior of the birds which seem to indicate that two distinct species are involved. In the vicinity of the seacoast, in the eastern Arctic as well as in the western Arctic (coastal Alaska, and apparently certain islands of northeastern Asia), two kinds of geese breed close together. They differ from each other in voice, nesting habits, habitat, and time of migration, as well as in color and size. In both regions, the voice of the smaller goose is described as a cackle, distinct from the honking of the larger birds. The cackling goose nests on small islands in ponds near the coast, while the larger one usually nests on higher ground a considerable distance inland, and, at least in the north country, frequently in willow thickets along streams. There is an almost unanimous agreement among those who have studied these birds on their breeding grounds that in both the Hudson Bay and Alaskan

* The term "white-cheeked geese" is used to include all of the races formerly included under *Branta canadensis*, not merely to refer (as in the fourth edition of the A.O.U. Check-List) to *Branta c. occidentalis*.

† For the loan of specimens I am greatly indebted to the National Museum of Canada, Carnegie Museum, Philadelphia Academy of Natural Sciences, Museum of Comparative Zoology, and the American Museum of Natural History.

regions two distinct species are present (Conover, 1926:175; Sutton, 1932:30–31; H. W. Brandt, 1943:276; and Soper, 1946:18).

None of these observers, however, has suggested that the small, dusky, cackling goose of the northwestern Alaskan coast belongs to the same species as the small, pale, cackling goose of the more eastern Arctic islands. Yet, I can see no reason for not doing so. They replace each other geographically, and in size and habits they are very similar. The validity of Taverner's assumption (1931:40) that the wide gap between their ranges argues against subspecific relationship is questionable; there are many recognized examples of conspecific races separated by equally wide gaps, particularly in species found in both the New and the Old World. The color differences between the eastern and western cackling geese seem to be bridged by the population inhabiting Bering Island, Siberia.

Nomenclature.—The earliest available name for the cackling geese is *Anser Hutchinsii* Richardson (1831 [1832]:470). Since this name was based on a very small bird from the Melville Peninsula, it almost certainly refers to the eastern race of the cackling goose, which becomes *Branta hutchinsii hutchinsii,* while the Alaskan cackling goose may be known as *Branta hutchinsii minima.* The very small goose of Bering Island, Siberia, and probably also the Kurile Islands (Taczanowski, 1893:1110), which also apparently breeds in the same region with a larger species, seems intermediate between *minima* and *hutchinsii* in appearance, although not in range. It seems to represent a distinct race, which may be called:

Branta hutchinsii asiatica, new subspecies. Asiatic Cackling Goose.

Type.—Adult ♂, No. 92827, U. S. National Museum; Bering Island, Siberia; June 9, 1883; Leonhard Stejneger; original number, 2165.

Subspecific characters.—Similar to *Branta hutchinsii hutchinsii,* but darker above. Similar also to *Branta hutchinsii minima,* but lighter below.

Measurements.—Adult ♂ (3 specimens from Bering Island): wing, 363–377 (Av. 368) mm.; tail, 110–119 (114.7); exposed culmen, 30.5–32.5 (31.7); tarsus, 65.5–77 (70.1); middle toe without claw, 57–62 (58.8). Adult ♀ (1 specimen from Bering Island): wing, 373; tail, 128; exposed culmen, 33; tarsus, 71; middle toe without claw, 54.

Geographic distribution.—Breeds on the Commander Islands, Siberia, and probably also the Kurile Islands (Bergman, 1935:225). Probably migrates southward at least to Japan (Taczanowski, 1893: 1110). Confusion in the nomenclature makes it impossible to be sure whether these references are for the present form, or for *B. canadensis leucopareia,* of which there is one breeding specimen, from Bering Island, in the American Museum of Natural History (No. 730928), first noted by Hartert (1920:141).

Among the medium-sized geese of the *Branta canadensis* group, which, as pointed out above, are a species distinct from *Branta hutchinsii,* two races seem to be recognizable, viz., a relatively dark bird from the islands of northeastern Asia east to Baffin Island, for which the name *Anser leucopareius* J. F. Brandt (1836:37) is available, and an extremely pale bird which breeds in the northern portion of the Prairie Provinces of Canada, which I believe should be called *parvipes.* Both seem to be subspecies of *Branta canadensis.* I have examined the type of *Anser parvipes* Cassin (1852), evidently a migrant bird, from Veracruz, Mexico, in the collection of the Academy of Natural Sciences of Philadelphia, and it agrees very closely with the pale medium-sized goose which breeds in the Lake Athabaska region. *Bernicla leucolaema* Murray (1859) is, in my opinion, unidentifiable but probably a hybrid.

The large Canada geese experience the widest range of ecological conditions on their breeding grounds and are also the most subject to racial separation. The extremely dark *B. canadensis occidentalis* occupies the relatively narrow area of southeastern Alaska and British Columbia south to Vancouver Island (Rand, 1943:60) during the breeding season. In the region from Hudson Bay south to Minnesota occurs a large intermediately-colored goose recently given the name *B. c. interior* by Todd (1938:662), who at the same time restricted the name *B. c. canadensis* to the pale-breasted bird of the Atlantic coasts of Quebec, Labrador and Newfoundland. This leaves a rather extensive area in which geese breed, at least scatteringly: the Great Plains of the northern United States and central-southern Canada, and the Great Basin from Utah west to northeastern California, and north to southern British Columbia. Breeding specimens from these regions are very large, a fact which has long been noted by residents in the Plains states (Wetmore, field notes 1922, and McAtee, 1944:136). These birds are even paler above than typical *canadensis,* from which race they are geographically separated by *interior,* a race which is darker than *canadensis* both above and below. Also the ecological conditions under which the plains and basin goose lives appear to be quite different from those of other races. There seems to be no alternative to recognizing it as a distinct subspecies, which may be known as:

Branta canadensis moffitti,‡ new subspecies. Basin Canada Goose.

Type.—Adult ♂, No. 365117, U. S. National Museum (Fish and Wildlife Service collection); Blue Lake, near Coulee City, Washington; April 26, 1938; V. Clifford.

Subspecific characters.—Similar to *Branta canadensis canadensis,* but larger and paler in general coloration. In fresh autumn specimens the brown areas of upper parts and flanks are between olive brown and buffy brown, rather than mummy brown. Under parts average somewhat less whitish.

‡ Named for James Moffitt, who had begun a revision of these geese just before his death in July 1943.

Measurements.—Adult ♂ (11 specimens): wing, 480–522 (Av. 502.8) mm.; tail, 144–177 (161.1); exposed culmen, 52–68 (57.9); tarsus, 84–106.5 (93.9); middle toe without claw, 76.5–92.5 (83.5). Adult ♀ (6 specimens): wing, 435–503 (474.3); tail, 121–166 (141.8); exposed culmen, 50–61 (54.8); tarsus, 85–93.5 (89.6); middle toe without claw, 76–84.5 (80.1).

Geographic distribution.—Great Plains and Great Basin regions of the United States and Canada west to eastern Washington and Oregon and northeastern California, east to northeastern North Dakota (Dawson), and south to Great Salt Lake, Utah, and central-western Nebraska, north to southern British Columbia and southern portion of the Prairie Provinces of Canada.

Relationship of races of Branta canadensis.—*B. canadensis moffitti* is the breeding Canada goose of the prairie and basin marshes of the more arid portions of interior North America, as compared with the more heavily forested region farther east, in which *B. c. interior* breeds, or presumably bred formerly, from Arkansas north to Hudson Bay, and east to Kentucky, Michigan, and western Quebec. Presumably *B. c. moffitti* intergrades with *B. c. parvipes*, a goose of similar pale coloration but of smaller size, in the middle section of the Prairie Provinces. It intergrades with *parvipes* also in British Columbia, as is indicated by an August specimen from Big Salmon River, British Columbia, which is distinctly smaller than the smallest *moffitti*, but too large for *parvipes* and much too pale to be considered *leucopareia*.

Although *B. c. moffitti* most closely approximates *B. c. canadensis* among the larger geese, it is larger, and enough paler above to be easily distinguished in series. Its habitat is evidently quite different from that of the maritime form, and its range is and probably always was completely cut off from that of *canadensis* by the still darker *B. c. interior*.

B. c. interior must have intergraded with *moffitti* in the general region where forest merges with grassland in the middle western region. It presumably intergrades with *leucopareia* along the western side of Hudson Bay and apparently also in southern Baffin Island.

Soper (1946:18) describes the decreasing size of breeding geese of the *canadensis* group along the southern coast of Baffin Island, saying that the smallest population breeds in the same general region with *hutchinsii* in the Cape Dorset region. His measurements of birds which he called *hutchinsii* from Cape Dorset certainly indicate that they were of that species, although the average which he gives for the wings of these birds, 12 inches [305 mm.] for males, and 11.77 inches [299 mm.] for the females, are remarkably small. Apparently he was not aware that *leucopareia* breeds in western Baffin Island, a fact disclosed by specimens in the National Museum of Canada and the Museum of Comparative Zoology, which I have examined. Average measurements which he gives for geese from the Fox Basin coast of western Baffin Island

MEASUREMENTS (IN MM.) OF ADULT BRANTA HUTCHINSII AND BRANTA CANADENSIS *

Male

Subspecies†	Wing (chord)	Tail	Exposed culmen	Tarsus	Middle toe without claw
B. hutchinsii					
minima (4)	353–373 (363.8)	109–116 (113.3)	26–28.5 (27.3)	64–70.5 (66.9)	48–53.5 (49.6)
asiatica (3)	363–377 (368)	110–119 (114.7)	30.5–32.5 (31.7)	65.5–77 (70.1)	57–62 (58.8)
hutchinsii (6)	360–393 (377.8)	116–133 (123.7)	31–35 (33.7)	67–77 (70.3)	54–61 (57)
B. canadensis					
leucopareia (22)	388–456 (410.2)	113–136 (127.3)	34–45.5 (37.8)	70.6–86 (76.6)	55–69 (60.9)
parvipes (7)	413–442 (430.9)	113–145 (132.7)	38–46 (42.6)	74–88 (81.7)	63.5–73 (68)
occidentalis (9)	446–493 (473.9)	137.5–162 (150.2)	45.5–54.5 (50.5)	84–99.5 (93.5)	75–83 (79.4)
interior (9)	430–473 (456.8)	131–149 (143.9)	46–55.5 (50.7)	81–91.5 (89.1)	67–80.5 (73.2)
canadensis (7)	444–485 (466.3)	131–149 (143)	53–58 (56)	88–95 (90.8)	72.5–83 (79.2)
moffitti (11)	480–522 (502.8)	144–177 (161.1)	52–68 (57.9)	84–106.5 (93.9)	76.5–92.5 (83.5)

Female

Subspecies	Wing (chord)	Tail	Exposed culmen	Tarsus	Middle toe without claw
B. hutchinsii					
minima (11)	332–371 (353.5)	97–117 (104.2)	26.5–32.5 (28.2)	58–70 (65.7)	47–58 (50.9)
asiatica (1)	373	128	33	71	54
hutchinsii (7)	350–381 (365.5)	116–117 (116.6)	31–32.8 (31.6)	65–68.5 (67.4)	52–55.5 (54)
B. canadensis					
leucopareia (22)	384–422 (400.3)	110–140 (124.5)	33–42 (37.3)	69–82 (73.4)	53–64.5 (58.6)
parvipes (2)	410–423	123–135	36–45.5	73–82	57.5–67
occidentalis (6)	437–471 (448.5)	139–152.5 (144.1)	44.5–50.0 (48.4)	84–92 (89.1)	72.5–79 (76.4)
interior (10)	427–467 (445.5)	133–155 (145.4)	45–53 (49.7)	76–90 (83.6)	68–76 (71.5)
canadensis (7)	435–488 (465)	134–158 (147.3)	51.5–56.5 (53.9)	81–88.5 (85.9)	72.5–80 (76.1)
moffitti (6)	435–503 (474.3)	121–166 (141.8)	50–61 (54.8)	85–93.5 (89.6)	76–84.5 (80.1)

* The measurements of immature specimens (detected by the plumage criteria described by Elder, 1946:98) were omitted from these tables.

† Figures in parentheses after the subspecies name indicate the number of specimens measured.

are somewhat larger than those of his Cape Dorset birds, and could have included some specimens of *leucopareia*.

B. c. leucopareia intergrades with *parvipes* in western Mackenzie. A specimen from Fort Simpson, Mackenzie, which is the type of *Bernicla barnstoni* Ross (1862), is referable to *parvipes*, as is also a specimen from the site of Old Fort Hope, 100 miles below Good Hope, Mackenzie. On the other hand, a breeding specimen from Great Bear Lake seems referable to *leucopareia*. In other words, *parvipes* is the interior, pale, representative of *leucopareia*.

The very much greater geographical range of *leucopareia* as compared with that of *parvipes* is further shown by the great preponderance of migrant specimens of the former race in collections. Although relatively few migrant specimens of *parvipes* have been examined, they are from extremely widely separated localities, as may be seen from the appended list of specimens.

Migrations.—From specimens of migrant geese and from bird-banding returns it would seem that there is considerable fanning out and crossing over by the various races during migration, as well as a distinct northward movement of Great Basin breeding birds. Although the summer residents of the Maritime region (*B. c. canadensis*) seem to remain fairly close to the Atlantic coast in migration, many birds of the Hudson Bay region (*B. c. interior*) cross to the Atlantic coast while others proceed down the Mississippi Valley. In fact, a big majority of the geese banded at the Mattamuskeet National Wildlife Refuge, on the coast of North Carolina, came from Hudson Bay, as indicated by both specimens and banded birds. All of the New England banded birds, however, were recaptured in the Maritime region and are therefore *B. c. canadensis*. Since *B. c. interior* has been found on the Atlantic coast only from Maryland southward it is apparent that the crossover occurs south of New England.

Another crosswise movement is found in *B. c. moffitti*. There are even extensive post-breeding northward movements of this race. There are records of breeding geese of Great Salt Lake, Utah, being retaken in December at Platte, South Dakota; and of breeding geese of Los Banos, California, being retaken at Scapa, Alberta, in October; of breeding geese of Great Salt Lake retaken at Brooks and Rocky Rapids, Alberta; of a goose from Voltage, Oregon, retaken at Del Bonita, Alberta; and of a goose from Burns, Oregon, retaken at Grand Prairie, Alberta.

Apparently *Branta canadensis occidentalis* and *Branta hutchinsii minima* confine themselves rather closely to the Pacific coast of North America in migration, the latter wintering chiefly in the interior valley of California (Swarth, 1913), although individuals wander to the Hawaiian Islands (for example, the type specimen of *"Bernicla munroii,"* which, I find, is a typical example of *B. h. minima*). *Branta c.*

leucopareia, as might be expected from its almost transcontinental breeding range, is found in migration from the Atlantic to the Pacific coast, but is particularly numerous from the Central Flyway westward.

Because of the paucity of records, we know much less about the migrations of the Athabaska Canada goose, *Branta canadensis parvipes*, and of the Hutchins cackling goose, *Branta hutchinsii hutchinsii*. On the whole, they both appear to follow chiefly the Central Flyway to New Mexico and Mexico. Occasionally they reach the Atlantic seaboard, and there are specimens of *hutchinsii* from as far west as Solomon, Alaska, and Klamath Falls, Oregon.

List of Specimens Examined

Branta hutchinsii minima, Alaskan Cackling Goose.—*Alaska:* Attu Island, 1 ♀; Hooper Bay, 1 ♀, 1 ?; Kotlik (mouth of Yukon), 1 ♂, 1 ♀; Nushagak, 1 ♂; Nushagak (Bear River), 1 ♀; Point Constantine, 2 ♀; St. Michael, 1 ♂, 2 ♀, 1 ?; St. Paul Island, 1 ♂ im. *California:* Gridley, 1 ♂, 2 ♀; Stockton, 1 ♀, 1 ?; Tule Lake, 1 ♀ im.

Branta hutchinsii asiatica, Asiatic Cackling Goose.—*Siberia:* Bering Island, 3 ♂, 1 ♀, 1 ? (head only).

Branta hutchinsii hutchinsii, Hutchins Cackling Goose.—*Alaska:* Solomon, 1 ♂ im.; *Illinois:* Andalusia, 1 ? im.; Chicago, 1 ?. *Iowa:* Whiting, 1 ♀; Wolf Creek Slough, 1 ♀. *Mexico, Chihuahua:* Guzman, 1 ♀ im.; *Jalisco:* La Barca, 1 ♂ im. *Nebraska:* Wood River, 1 ?. *Nevada:* Washoe Lake, 1 ? im. *North Carolina:* Crow Island, 1 ♂ im.; Fairfield, 1 ?; Lake Mattamuskeet, 1 ♂ im. *North Dakota:* Lac-aux-Morts, 1 ♂. *Northwest Territories, Franklin:* Baffin Island, 1 ♀; Baffin Island (Camp Dorset), 1 ♂; Baffin Island (Camp Kungovik), 2 ♂, 3 ♀; Melville Peninsula, 1 ♂. *Keewatin:* Southampton Island (Ranger Brook), 1 ♂. *Oklahoma:* Kiowa Agency (4 mi. from, on Wachita River), 1 ♀. *Oregon:* Klamath Falls, 1 ♀ im.

Branta canadensis leucopareia, Lesser Canada Goose.—*Alaska:* Agattu, 1 ♂; Barter Island, 1 ♂; Chogiung, 1 ♀ (head only); Egushik River, 1 ♂; Fort Kenay, 1 ?; Kotlik, 1 ♂; Kuskokwim River (North Fork, base Mt. Sishwoo), 1 ♂; Nulato, 1 ♂; Nulato River, 2 ♂; Nushagak, 1 ♀; Nushagak River (80 mi. up), 1 ♂; Old Crow River (mouth Black Fox Creek), 1 ♀; Putnam River, 2 ?; St. Michael, 1 ?; St. Paul, 1 ?; Tanana Crossing, 1 ♂, 1 ♀, 1 ?; Tanana Crossing (15 mi. below), 1 ♂. *British Columbia:* Puget Sound (Semiahmoo Camp), 1 ♂, 1 ?. *California:* Gridley, 1 ♂, 4 ♀; San Francisco, 1 ?; Stockton, 1 ?; Locality ?, 1 ?. *Florida:* St. Marks River (Wakulla County), 1 ♀. *Illinois:* Chicago, 1 ♀ im., 1 ?. *Iowa:* Sloan, 1 ♂; Sloan (near), 1 ♂. *Minnesota:* Red River, 1 ?. *Nebraska:* Platte River (Elm Creek), 4 ♀, 1 ?; Wood River, 2 ♂, 4 ♀, 1 ♀ im. *Nevada:* Stillwater (3 mi. N.), 1 ♀; Washoe Lake, 1 ♂. *New Mexico:* San Antonio, 1 ? im. *Northwest Territories, Franklin:* Baffin Island (west coast), 2 ♂;

Dolphin and Union Strait (between Franklin and Mackenzie), 1 ♂; Victoria Island (Walker Bay), 1 ♀. *Keewatin:* Kazan River (lower), 1 ♀ im. *Mackenzie:* Cape Fullerton (Hudson Bay), 1 ?; Franklin Bay (island in), 1 ♀; Great Bear Lake, 1 ♂; Thelon River (The Gap), 1 ♂. *Yukon:* Herschel Island (Mackenzie Bay), 2 ♀; International Boundary and Arctic Circle, 1 ?; Old Crow River, 1 ♀; Old Crow River (Timber Creek), 1 ♂, 1 ♀; Old Crow River (Timber Creek, 15 mi. above), 1 ♀. *Oregon:* Silver Lake, 1 ♀. *Siberia:* Bering Island, 1 ♀. *South Dakota:* Vermillion, 1 ♂. *Virginia:* Neabsco, 1 ?. *Washington:* Kiona, 1 ♂. [*Washington*]*:* Camp Lopez, 1 ♀; Columbia River, 1 ?.

Branta canadensis parvipes, Athabaska Canada Goose.—*Alberta:* Athabaska River (near Sled Island), 1 ♂ im.; Egg Lake (15 mi. N. W. Fort Chipewyan), 1 ♂; Lake Athabaska (Goose Island), 1 ♂, 1 ♀. *Georgia:* Brady County, 1 ♀. *Manitoba:* Steel River (2 miles below mouth Fox River), 1 ♂ juv. *Mexico, Veracruz:* Locality ?, 1 ?. *Nevada:* Camp 26, 1 ♂; Truckee Meadows (Camp 26), 1 ♂. *New Mexico:* Rio Rita (near Laguna), 1 ?. *North Carolina:* Currituck Sound, 1 ?. *Northwest Territories, Mackenzie:* Fort Simpson, 1 ♂; Hope (100 mi. below Good Hope; site of old Fort Hope), 1 ♂.

Branta canadensis occidentalis, Pacific Canada Goose.—*Alaska:* Chichagof Island (Hoonah Sound), 1 ♂, 1 ♀; Gustavus Point, 1 ♂; Juneau, 1 ♂; Keku Pass, 2 ♂, 2 ♀; Prince of Wales Island, 1 ?; Sergif Island (mouth Stikine River), 1 ♂; Stikine River Flats, 2 ♂, 3 ♀, 1 ?. *British Columbia:* Semiahmoo, 1 ♂. *Washington:* Port Townsend, 1 ?; Puget Sound, 1 ?.

Branta canadensis interior, Interior Canada Goose.—*Alabama:* Leighton, 1 ♀; *District of Columbia:* Washington, 1 ?. *Illinois:* Chicago, 1 ?. *Maryland:* Marlboro, 1 ♂; Seneca, 1 ♂; Upper Marlboro, 1 ?. *Michigan:* Black Lake (Ottawa County), 1 ♀. *Minnesota:* Elk River, 1 ♀, 1 ?. *Mississippi Valley:* Locality ?, 1 ♀. *Nebraska:* Gibbon, 1 ♂; Platte (Elm Creek), 1 ♂; Wood River, 1 ♂, 1 ?. *North Carolina:* Currituck Sound, 1 ♀, 4 ?; Poplar Branch (Pine Island), 1 ?. *Ontario:* Belcher Islands (Tukarak Island), 2 ♀; Hudson Bay (Povungnituk), 1 ♀; Point Pelee, 1 ?; St. James Bay (Nattahisha Point), 1 ♀ im. *Pennsylvania:* Carlisle, 1 ♂. *Quebec:* Fort George (east side James Bay), 1 ?; Hudson Bay (Nastapoka River, 5 mi. S.), 1 ♂; Port Harrison, 2 ♂; St. Augustine (Portneuf), 1 ♂. *South Dakota:* Aberdeen, 1 ♂. *Texas:* Houston, 1 ♀, 1 ?; Lavaca Forks, 1 ♂. *Virginia:* Buckingham County, 1 ♀.

Branta canadensis canadensis, Eastern Canada Goose.—*Maine:* Merrymeeting Bay, 1 ♂ im. *Maryland:* Ewell, 1 ♂. *Michigan:* Schoolcraft County (Waterfowl Refuge), 1 ♂. *Newfoundland:* Addies Pond, 1 ♀; Humber River (upper), 1 ♂, 1 ♀. *North Carolina:* Avon,

1 ♂; Nanteo (Pea Island), 1 ♂, 5 ♀; Pea Island, 2 ♂. *Rhode Island:* Lake Worden, 1 ♂. *Virginia:* Back Bay (Princess Anne County), 2 ?; Uptonburgh, 1 ♀ im.

Branta canadensis moffitti, Basin Canada Goose.—*British Columbia:* Big Salmon River, 1 ?. *California:* Bodega, 1 ?; Brownell, 1 ♂; Camp Bidwell, 1 ?. *Missouri:* Macon, 1 ♂; *Montana:* Crooked Falls, 1 ♂. *Nebraska:* Wood River, 1 ?. *North Dakota:* Dawson, 1 ♂; Devils Lake, 1 ♀; Glasston (Pemberton County), 1 ♂; Robinson, 3 ♂, 2 ♀; Sweetwater Lake, 1 ♀. *Oregon:* Dary, 1 ♂ im.; Olene, 1 ? im. *South Dakota:* Platte, 1 ♂. *Utah:* Bear River Mouth, 1 ♂, 1 ♀ im.; Locality ?, 1 ?. *Washington:* Blue Lake (near Coulee City), 1 ♂, 2 ♀.

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SUPPLEMENTARY NOTES ON THE FAMILY ANATIDAE

BY JEAN DELACOUR AND ERNST MAYR

SINCE the appearance of our paper, "The Family Anatidae" (1945, *Wilson Bulletin*, 57:3–55), a few contributions to the subject have come to our knowledge, and some new facts have been reported. We think it worth while to mention them briefly.

To start with, certain of our statements might be modified as follows:

Some mergansers carry their chicks on the back, as do the Mute and Black-necked Swans (p. 9).

A few river ducks (Anatini) have no metallic colors on the speculum. Such is the case in *Anas strepera, A. angustirostris,* and in the aberrant forms: *Hymenolaimus malacorhynchos, Malacorhynchus membranaceus, Rhodonessa caryophyllacea,* and *Stictonetta naevosa* (p. 16).

The downy young of *Heteronetta atricapilla* is known, although so far undescribed (p. 54). We have examined two specimens: one is a mounted chick, lent by Herbert Friedmann, U. S. National Museum, Washington, which served as the model in the preparation of Figure 1. It was collected at Batuco Lake, 50 kilometers north of Santiago, Chile. The egg was found on September 23, 1938, in a nest of a Red-gartered Coot (*Fulica armillata*). The egg hatched on October 16, and the bird died five days later. The second is a skin lent by Josselyn Van Tyne, University of Michigan Museum of Zoology (No. 93120, ♀, 195–200 kilometers west of Puerto Casado, Paraguay, March 1, 1937, Schulze and Lopez). The accompanying figure by Alexander Seidel depicts accurately the very peculiar color pattern of this species. Unfortunately, the pattern gives no clue to the relationships of *Heteronetta.* Unique features of the duckling of this species are: unusual length of the yellowish tips of the dark down on the hind neck and upper back, and the speckled pattern on the yellow of the back, sides, and wings, produced by some long black tips. The general effect is that of a hairy and shaggy chick. The dark areas of the plumage are brown, becoming blackish-brown on the lower back, flanks, and tail. The supercilium is tawny; the sides of the head and throat are also tawny but a little darker. The breast is brownish-yellow, with a darker collar separating upper and lower throat; the abdomen paler. The markings on the wings and sides, as well as the lines on the back, are yellow. The Puerto Casado specimen is somewhat distorted by the make-up of the skin. It seems to differ from the Batuco Lake specimen in the following points: The lower abdomen and the flanks are heavily mottled with black. The superciliary stripes seem to be almost connected across the hindneck, though less pronouncedly so than in *Dendrocygna.* The longitudinal

stripes on the back seem to turn toward the flanks at their posterior ends. It remains to be seen whether any of these characters is typical for the species.

About the habits of the Bronze-winged Duck, *Anas specularis* (p. 18) Lord William Percy (*in litt.*) says:

"I lived with them for a month on a river at sea level in south Chile and, except for the similarity in the plumage pattern of the wings to that of the Crested Duck (*specularioides*), they always struck me as typical river ducks with nothing else reminiscent of a Crested Duck in their manner and habits. As to their voice there should be no doubt about that, for it is the most remarkable of any duck I know. The female's bark is as perfect an imitation of that of a small lap dog as any bird could make and I frequently mistook their note for that of dogs in the distance. I was never quite sure whether the males bark too, but they certainly have a distinctive note of their own—a single

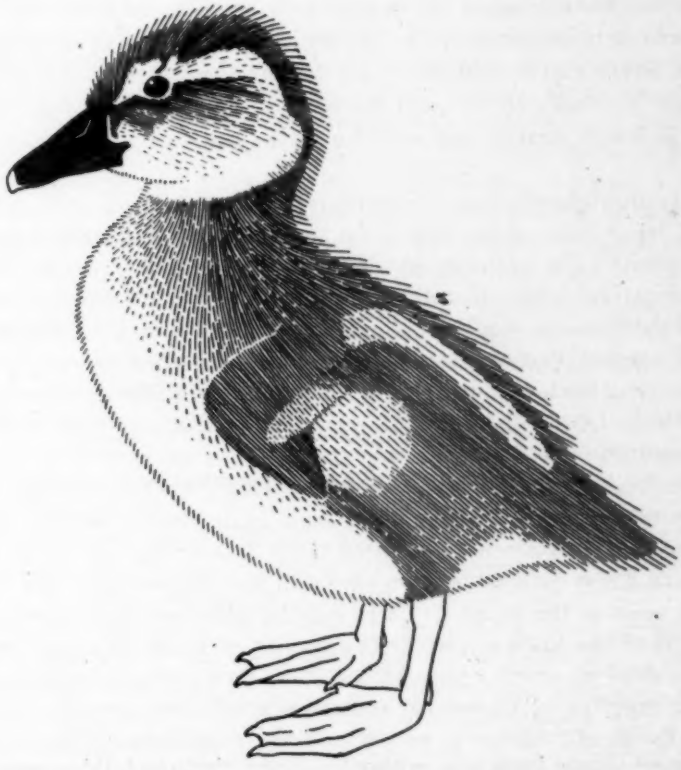

Figure 1. Black-headed Duck (*Heteronetta atricapilla*). Drawn by Alexander Seidel.

whistling note frequently repeated, but they either remain silent when the females are barking or bark too, because I never heard the whistle and barking at the same time."

Dr. John Berry, Edinburgh, Scotland, reports (*in litt.*) a case of fertility between a hybrid male *Anser anser* × *Branta bernicla* and a female of *Branta bernicla:*

"I consider that the fertility of one hybrid male of this cross was established when a Barnacle female to which he was mated, produced a gosling at Tayfield in 1944. Of course, one cannot absolutely rule out the possibility that the Barnacle mate, being full-winged, had paired with a Greylag gander. But so far as our observation went this did not occur, and all the observations pointed to the Barnacle's fertile egg having resulted from union with the hybrid gander. I was able to compare the one resulting gosling which I reared with direct hybrid goslings resulting from a Greylag × Barnacle cross. While this gosling was quite definitely not a pure Barnacle, it resembled that species much more closely than did the 'half and half' hybrids. This year the same pair of birds nested again but no eggs were hatched. At least one, however, was certainly fertile as the gosling was well formed in the egg."

Dr. Berry also rightly points out that in the Anserini, the voice of the male is usually shriller and more metallic than that of the female, which is lower, weaker, and not of a higher pitch as stated by us. He says:

"My own observations are restricted to comparatively few species, but so far as most of the true geese are concerned, I should have said the opposite. For example, in the Pink-footed Goose [*Anser fabalis brachyrhynchus*], the call note of the male is a shrill "wink wink," while that of the female is much lower. In the 'talking voice' the difference is equally marked, that of the gander being higher pitched, more nasal and metallic than the low 'muttering' of the female. The talking voice of the Bean Goose [*Anser f. fabalis*] shows a similar distinction between the lower muttering of the female and the higher more nasal voice of the ganders. The call notes of Greylag [*Anser anser*] are more or less similar, but the 'talking voice' of the female is again lower than that of the male, so too, with my White-fronted Geese [*Anser albifrons*]. I think the Snow Geese [*Anser caerulescens*] can also be sexed by the lower talking voice of the females. There may be wide variation between individuals of the same species in this matter of voice. The number of geese is small on which I have been able to determine sex beyond question by breeding or dissection, and on which I have previous precise notes of voice (confirmed by numbered rings on both legs). But in each such case I should have said, without a doubt, that the talking voice, at least, of the female was lower than that of the male."

Mr. C. L. Sibley, Wallingford, Connecticut, also reports an interesting secondary hybrid:

"You may be interested to know that this season I hatched three young from five eggs laid by a female which was herself a hybrid between a male Blue-winged Goose (*Cyanochen cyanopterus*) and a female Egyptian Goose (*Alopochen aegyptiacus*). This hybrid female mated with a Blue-winged gander which was her half-brother, and whether it was this close relationship, or inherent weakness of the three-quarters blood Blue-wing young, I lost all three.

"I had supposed that a hybrid of *Cyanochen* and *Alopochen* would be sterile, yet she laid normal-shelled eggs and hatched three. All five eggs were fertile."

New observations of the display of the Maned Goose (*Chenonetta jubata*) have been made and reported by Delacour (1945, *Wilson Bulletin*, 57:129). They confirm the relationship of this species with the Mandarin and Wood Ducks (*Aix*).

In 1941, Finn Salomonsen published a detailed study of the plumages of the Old-squaw (*Clangula hyemalis*) in which he disagrees with Sutton's conclusions that the species has only two molts and plumages per year. According to Salomonsen, the Old-squaw drake has no less than four plumages: a winter or courtship plumage, breeding or nuptial plumage, eclipse plumage, and autumn plumage. These are rather startling conclusions, but we lack the material to discuss them critically. It remains to be seen whether Salomonsen's interpretation of the plumages of this species are valid. In detail, his findings are as follows:

The winter plumage is worn until April. Around April 10 to 15 the molt into nuptial plumage begins and is completed toward the end of May. This molt affects only head, neck, throat, and the scapulars. The molt into eclipse plumage begins around July 1. There is a period of about three or four weeks in June during which practically no molt takes place. The eclipse molt is completed by the end of August. This molt affects the entire plumage not changed in the previous molt and, according to Salomonsen, also the scapulars. It appears to us that this molt is nothing but a continuation of the April-May molt, even though there may have been some lag during June. It is in this molt that wings and tail are renewed.

A new molt starts in September which affects the feathers of head, neck, throat, flanks, and scapulars. Most of these feathers remain as part of the winter plumage, but the white autumn feathers of the sides of the neck, lores, cheeks, and of the eye and ear region are replaced by the final feathers of the winter plumage.

Although Salomonsen records four molts and four plumages, it follows from his own data that no individual feather papilla has more than one or two molts per year, except the scapulars and some feathers of the head, which, according to him, are molted three times a year. His data also show that there is some scattered molting going on throughout the

year, except from January to March. Thus, actually, Salomonsen's conclusions deviate less from previous descriptions than he implies.

Our knowledge of the molts and plumages of ducks has been notably advanced by Stresemann (1940). His conclusions are based on a series of molting summer ducks from Tibet, where it is apparently easier to get molting pintails and widgeons than in the United States or in Europe! The sequence of molting is different from that described in the current literature. Molt begins with the flank feathers, scapulars and upper tail coverts. Next is the central pair of tail-feathers and the tertials. When the molt of the central pair of tail-feathers is complete, about half the body plumage is in molt, namely, on the upper parts: all the feathers of the crown, many on the sides of head and neck, many of the scapulars, upper tail coverts, and feathers on the middle of the back; on the underparts: nearly all the flank feathers, many feathers of the breast and belly, and many under tail coverts. The last body regions to molt are upper back, rump, upper throat, and chin. In fact, some parts of the rump may never acquire the eclipse plumage. When two to four pairs of tail feathers have molted, the wing is molted. All the wing feathers, wing coverts, and axillaries are molted simultaneously. The tail-feathers molt in the sequence: 1, 2, 4, 6, 7, 3, 5, 8, with some variation in the outer 3 or 4 pairs.

The second half of Stresemann's paper is devoted to a stimulating discussion of the physiological factors that control the plumage. The starting point is the fact that gonadectomized (castrated) adult mallards (male and female) wear the nuptial plumage of the drake throughout the year. This is usually called the "neutral" plumage of the species.

Gonadectomized ducklings, however, retail the normal juvenal plumage (acquiring it again even after plucking), which is for them the neutral plumage. Gonadal hormones obviously produce the eclipse plumage of the male and the "henny" plumage of the immature duck, male and female. Why the juvenal plumage does not react to absence of sex hormones has long been a puzzle. Stresemann suggests that the nuptial plumage of the drake (the "neutral" plumage of the adult) is the mature plumage of the species, and that the maturation process occurs independently of hormones. This same interpretation was advanced some time ago: "All these observations and experiments allow the following interpretation: one of the phenomena of reaching maturity in birds is a gradual change in the structure and pigmentation of the feathers from an immature plumage to a neutral adult dress. This change appears to occur in steps as expressed in the successive molts required to produce the final plumage, but is actually caused by a slow physiological change, as has been proved by plucking feathers between molts. This process is modified by an additional differentiation caused by a female or male hormone, which changes the neutral plumage to a typical female or male adult plumage. This latter process can be reversed by the removal of the gonads, while the change from the im-

mature plumage to the 'Neutral Plumage' seems to be irreversible and independent of any hormones thus far known" (Mayr, 1933:10). Stresemann feels that this interpretation is strengthened by the observation of Heinroth and Lorenz that the eclipse plumage of old drakes is less henny (more nuptial-like) than that of younger drakes. This Stresemann interprets to mean that the older ("more mature") the feather papillae become, the less subject they are to the inhibitory effects of the sex hormones.

An alternative hypothesis would be that it is not the reactivity of the feather papillae which changes, but the level of other endocrine antagonists, such as the hormones of thyroid, pituitary, and the adrenals. Only experiment can tell which of the alternatives is correct—or if the truth is a combination of both processes. Two recent papers throw some light on the problem: Boss (1943) showed that injection of male sex hormone in the chicks of Herring Gulls (*Larus argentatus*) causes them to assume a nuptial plumage in the next molt though they revert to the juvenal plumage as soon as the administration of hormones is discontinued. At least in this species, then, the change from juvenal to adult plumage is not entirely a matter of maturation. Even more significant are the experiments by Chu (1938) on the influence of thyroid hormone on the juvenal plumage of chicks. He shows that thyroidectomized chicks assume a juvenal plumage with the essential characters of the adult neutral plumage. Further work on this question is now being done at the University of Chicago by B. B. Blivaiss and L. V. Domm.

Stresemann's statement that the assumption of the eclipse plumage is not correlated with any special physiological condition of the testes is not convincing. It seems always to be true that the nuptial plumage is acquired during the resting stage of the testes, whereas the eclipse plumage is formed under the influence of an active testis (even though it may be rapidly decreasing in size). A superimposed influence of the thyroid hormone (affecting the growth rate of the new feathers) does not materially change this relationship.

In a final section, Stresemann discusses the manifold correlation between ecology, breeding cycle, and sequence of molts and plumages. It would lead too far to repeat here his many stimulating observations. Every student, either of ducks or of the plumage physiology of birds, should study this pioneer contribution in its entirety.

Lorenz's paper (1941) on the comparative ethology of river ducks has now also reached us. His conclusions on the interrelations of the Anatini are in nearly complete agreement with our conclusions. We hope that it will soon be possible to make this work available to American readers in an English translation, not only for the importance of his conclusions but also as a model of modern ethological technique.

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GENERAL NOTES

The Redhead as a breeding bird of Michigan and Ontario.—A downy young specimen of the Redhead (*Aythya americana*) that, according to the label, was "with 5 others on back of female" when collected at Walpole Island, Lake St. Clair, Lambton County, Ontario, about 1900, has been in the collection of the Royal Ontario Museum of Zoology (No. 32, 8, 29, 53) since its receipt in 1932 incorrectly identified as a Lesser Scaup (*Aythya affinis*). The identification was made by the collector, W. G. A. Lambe, of Toronto, and I have twice recorded it as a Lesser Scaup. T. M. Shortt detected the error in 1941 in the course of studying the Museum's duck collection for the purpose of illustrating Francis H. Kortright's "The Ducks, Geese and Swans of North America."

Female Redhead (*Aythya americana*) with newly-hatched young, Delta, Manitoba, 1946. From a painting by H. Albert Hochbaum.

Although there is no evidence that the Redhead breeds at present anywhere in Ontario, that it did so formerly at Lake St. Clair and, once, at Toronto, is shown by the following records:

St. Clair Flats, 1877—Broods reported ("Rover," *For. & Str. and Rod & Gun*, 9, 1877:34).

St. Clair Flats, 1877—Bred in large quantities ("Venator," *For. & Str. and Rod & Gun*, 9, 1877:73).

St. Clair Flats, Michigan, 1879—Two nests (W. H. Collins, *Bull. Nuttall Ornith. Club*, 5, 1880:61–62).

St. Anne Island, Lake St. Clair, Lambton County, Ontario, May 27, 1882—Nest with 10 eggs; June 22, 1882—Nest with six eggs (John H. Morden, *Canad. Sportsman & Nat.*, 3, 1883:218–219). The second set of eggs is now in the Royal Ontario Museum of Zoology. Morden's article gives the locality as "Mitchell's Bay."

St. Clair Flats—Nesting (J. H. Langille, *For. & Str.*, 22, 1884:384).

St. Clair Flats—Nesting (J. H. Langille, "Our Birds in Their Haunts," 1884: 467–468).

St. Clair Flats, 1886—Most common nesting duck (J. H. Langille, *Bull. Buffalo Soc. Nat. Sci.*, 5, 1886:34–35).

Walpole Island, Lake St. Clair, Lambton County, Ontario, about 1900—Six downy young on back of female, seen by W. G. A. Lambe. One, collected, is in the Royal Ontario Museum of Zoology. (Recorded as five young Lesser Scaups by James L. Baillie, Jr., *Trans. Royal Canad. Inst.*, 21, 1936:16; and *Wils. Bull.*, 51, 1939:184.)

Toronto Island, 1900—Brood of 12 seen, according to C. W. Nash's journals in the Royal Ontario Museum of Zoology. The note, under date of August 7, states: "I have just heard of a brood of Redhead 12 in number that were hatched in Jim Crow pond Toronto Island this year; they were seen by Mr. George Warin, Hector McDonald & several others."

Dickinson Marshes, Lake St. Clair, Michigan, 1901—Pair reported nesting (Walter B. Barrows, "Michigan Bird Life," 1912:91).

Near Krauss's Hotel, Wayne County, Michigan, 1908—Four pairs nested (J. Claire Wood, *Auk*, 27, 1910:38).

The Redhead's status as a breeding bird of Michigan rested on the above records of its former nesting around Lake St. Clair until 1941, when a record of eggs from Saginaw Bay was received at the University of Michigan Museum of Zoology. —James L. Baillie, Jr., *Royal Ontario Museum of Zoology, Toronto, Ontario, Canada.*

Catbird "anting" with a leaf.—On August 20, 1945, at a few minutes after 6 a.m. (C.S.T.), I saw a male Catbird (*Dumetella carolinensis*) "anting" with a small, narrow, silvery-green leaf, apparently from one of the many plants of the weed pussytoe (*Antennaria neodioica*) growing in the lawn a few yards away. The Catbird appeared to rub the leaf at the base of the tail; at the same time he turned the tail forward under the body, losing balance, and all but toppling over. He then hopped off a few inches, keeping the leaf in his beak, and repeated the rubbing. He had done this twice more when a Blue Jay (*Cyanocitta cristata*) flew down beside him; then, still holding the leaf, he flew into a hedge and out of sight. H. R. Ivor (1941. *Auk*, 58:416) reports a captive Catbird "anting" with ants. Of the 19 species that he observed "anting," all used ants except one, a Bronzed Grackle (*Quiscalus quiscula aeneus*), which "anted" with choke-cherries. W. L. McAtee (1938. *Auk*, 55:98–105), reviewing the literature of "anting," reports no case of the use of leaves. The pussytoe leaf is very wooly but not pungent or aromatic. Although the Catbird that I watched seemed to rub its tail, Ivor (1943. *Auk*, 60:53) found by close observation of his birds that in every instance they were trying to reach "the very tip of the primary which often was resting on the tail."—Ruth Harris Thomas, *Route 3, North Little Rock, Arkansas.*

Bronzed Grackle "anting" with mothballs.—On the morning of April 5, 1946, five male Bronzed Grackles (*Quiscalus quiscula*) alighted in the back yard of my home in Cleveland, Ohio, and began scratching around in a flower bed that had been scattered with mothballs as a protection against dogs. Suddenly one Grackle was observed rubbing the underside of his spread wing and the part of the body under the wing with a mothball held in his bill. After several applications, he dropped the ball and preened his feathers. He then picked up the ball again and treated the other wing, as well as the belly, rubbing the mothball on the feathers as far back as he could reach with his head between his legs. He "anted" in this fashion approximately 20 times in about 15 minutes and then flew away. The Grackle followed no regular order in treating the various parts of his body but seemed to give them all about equal attention.—Raymond W. Hill, *3316 Kenmore Road, Shaker Heights, Cleveland, Ohio.*

Thure Kumlien and the early history of the Philadelphia Vireo.—Thure Kumlien, in the 1850's, recognized that one of the Wisconsin vireos differed from the Warbling Vireo (*Vireo gilvus*) but had no description of it, since the 1840 edition of Wilson by Brewer was his only ornithological reference book. Eventually the bird was determined to be the Philadelphia Vireo, but the history of this vireo in the 7 years following its discovery is a comedy of errors. Kumlien's observations have been underestimated in some quarters and overestimated in others. In 1921, P. V. Lawson wrote: "Why this rare and little known beauty of the orchard and forest was not properly given the name 'Kumlien Vireo' for its discoverer, the author cannot now ferret out. This late justice is accorded our modest naturalist."[1]

Recently Mrs. H. A. Main gave to the Wisconsin Historical Society the correspondence between Thomas Mayo Brewer and Thure Kumlien. Though there are gaps in the correspondence, especially in the Kumlien series, it is now possible to trace Kumlien's work on this bird with considerable accuracy.

On February 11, 1851, John Cassin[2] read a paper before the Academy of Natural Sciences of Philadelphia, in which he described as new a vireo (*Vireosylvia philadelphica*) taken by him at Philadelphia in September 1842. It was the only specimen that he had seen. Curiously, he later failed to recognize Wisconsin specimens of the same species.

It is possible that prior to 1854 Kumlien was aware that he had a new vireo, but the records do not show this. He had been in correspondence with Brewer since 1851, and if his questions about the bird had arisen prior to 1854, it is reasonable to suppose that he would have mentioned them in his letters. In 1854 he sent specimens to Brewer and apparently wrote of his inability to identify them satisfactorily: on the back of a letter from Brewer to Kumlien, dated November 10, 1854, appears the notation by Kumlien, "About the Virio—to Brewer." On November 20 of the same year Brewer inquired, "Is not the other species you speak of the white-eyed vireo?" On the twenty-fifth of the following March (1855) Brewer wrote that he was visiting John Cassin and Spencer F. Baird, adding: "The other vireo, smaller than the gilvus is supposed to be a new species—Bell's vireo." Again, on May 10, Brewer wrote: "Shoot birds with their eggs and you may thus come at Bell's vireo with its eggs." Who was responsible for this misidentification cannot be determined. Audubon, in 1844, had described Bell's Vireo from a specimen shot by John G. Bell, May 6, 1843, while they were on the Missouri River expedition; but Kumlien did not have access to this description.

There was doubt in Kumlien's mind whether he had Bell's Vireo. A draft of a letter to Brewer, dated January 15, 1856, shows how his bird differed from the known vireos, and there appears the line: "? 7. *Virio Bellii?.*" In 1903, L. Kumlien and N. Hollister published on this subject the following wholly erroneous statement: "In the early forties Thure Kumlien procured specimens of a vireo which he called *belli*, of which he had no description, simply to distinguish it from *gilvus*. This led to some confusion with Lawrence, Baird, and others who had not seen the specimens. The bird referred to was later described by Cassin as *V. philadelphicus.*"[3] Thure Kumlien did not find the vireo in the early forties, he did not name it *belli*, nor is there any clear evidence that he realized its distinctness before Cassin. No one in the east received any of Kumlien's skins until after Cassin had described the bird.

It will be shown below that Brewer received specimens of the Philadelphia Vireo from Kumlien in 1854. Others were forwarded to him in 1855. On January 11, 1856, Brewer wrote to Kumlien: "Nos. 5, 6 & 7 are vireo gilvus in an unusually fresh plumage." Kumlien was sure of his grounds, and his reply showed clearly the difference between his vireo and *gilvus:* "In regard to the Vireo which I sent you last being the *Vireo gilvus* 'in an unusually fresh plumage', I beg your perusal of the following remarks. You may think it bold in me, but so far as I read Wilson I am not satisfied in regard to this vireo matter.

"*Vireo gilvus,* Wilson—in every respect agreeing with Wilson's description—is common here from the 8th or 10th of May till September. It consequently breeds here. It is an excellent singer. I have a number of skins, and all agree in their markings. There is very little difference between its spring and autumnal dress. It is found in openings more than in thick timber, and frequently near farm-houses. Its length varies from 5½ to 6 inches; I have one that measures full six. *Vireo* – ? — that which I sent you, and which cannot be *V. gilvus* if the preceding is—is by no means so common as the other, and I have never observed it before May 15th, and only from the 15th to the 25th of May and in September. I never heard this bird sing a note. It keeps in the most secluded thickets; I never found it anywhere else. It is a smaller bird than the other. Its length is from 5 to 5¼ inches, which is the longest I have ever found. I admit that in general markings both birds are very much alike, but the *gilvus* is a more slender bird than the other, which appears stouter. Between the spring and autumnal dress of the *gilvus,* as I have said, there is but little difference in the markings, but the other, in autumn, is considerably tinged with yellow."[4] Kumlien also showed the important difference between the two species in the length of the primaries.

The above letter was convincing, for Brewer wrote on April 14, 1856: "I would like to have you identify if you can your Vireos with their eggs. I am in hopes you may thus be able to clear up the present mystery, though the facts of your last letter satisfy me that Mr. Cassin must have been a little hasty in his examination of your specimens. After what you say there can be no doubt that the two species are distinct." Kumlien replied that he thought his vireo distinct "though I don't know if it has been discovered before I did or not." On September 29, 1856, Kumlien wrote Brewer regarding some skins that he had prepared, including "my vireo 1 in autumn dress."

Cassin had been quite hasty in his examination, for Brewer wrote to Kumlien on December 28, 1856: "I showed him [Cassin] what you wrote me about that Vireo. We consulted together about it and have no doubt that you are quite right about it. It is a new species described by Cassin . . . as Vireosylvia Philadelphica. Its genuineness has been disputed but now you have verified his correctness and I have prepared a paper for our Boston society in which I mean that you shall have all due credit. Get all the skins of this that you can. I think I can get some tall prices for them out of Bell and others."

Early in 1857 Kumlien wrote to Brewer: "So Mr. Cassin makes a new genus of my vireo! [Kumlien was familiar only with the genus *Vireo* in Wilson's book.] Has it been found anywhere else? And has he any other specimens than those in fall plumage? There is a deal of diff[erence] in spring & fall plumage. Last spring only one was shot and that was unfit for skinning. Singular that all I ever got were shot in one small thicket."

Brewer, on January 7, 1857, read a paper on *Vireosylvia* before the Boston Society of Natural History, in which he praised Kumlien for his keenness of observation: "Two years since [1854], my attention was called by Thure Kumlien, Esq., a very accurate and careful ornithologist of Wisconsin, to a specimen of Vireosylvia obtained by him near Lake Koskouong, in the southwestern [*sic*] part of that State. He thought it a distinct species from any he had seen any description of, and quite distinct from the *V. gilva.* I gave the specimen to a friend, upon whose judgment I relied more than . . . upon my own, who pronounced it a *V. gilva.* Mr. Kumlien was not satisfied with this decision, and still insisted that its habits, even more than its plumage and size, showed it to be a distinct species. The following year [1855] he sent me several specimens which I gave to Mr. Cassin, who had no doubt that they were of the species he had described as *V. Philadelphica,* though others to whom I showed them were still unconvinced. In answer to a letter in which I informed Mr. Kumlien that his birds were supposed to be the *V. gilva* in an unusually fresh plumage, he wrote me the answer which I give

below. It proves, to my mind, conclusively his correctness, establishing the species to be a good one, distinct from *V. gilva* and identical with that described by Mr. Cassin as *V. Philadelphica*. I take the greatest pleasure in thus giving Mr. Kumlien the credit of having worked it out, unaided by any suggestion or help from any one, in view of the disadvantages under which he labors in the want of access to any text-books. His letter is interesting, as throwing the first light that has yet been given to the public upon the habits and distribution of this new and little known species."[5]

Brewer wrote to Kumlien on May 1, 1857: "In the second place he [Cassin] will give you ... 50 cents each for as many of the vireo philadelphica as you can procure. ... He wants you particularly to send him specimens of *vireo gilvus*, just to demonstrate finally that you know the species, though of this he has not a doubt. ... He is pleased to compliment my paper about the vireo philadelphica in which I publish your letter to me written a year ago." There is an element of humor in Cassin's solicitude over Kumlien's ability to recognize *V. gilvus* when he himself did not distinguish Kumlien's specimens of *philadelphicus* from those of *gilvus*. In this connection it is curious that Kumlien should have recognized *philadelphicus* as a new species and at the same time confused *gilvus* (the Warbling Vireo) with so well marked a species as *solitarius* (the Blue-headed). After examining with Baird a shipment of skins from Kumlien, Brewer wrote to Kumlien on October 26, 1854, that "No. 5 and 6 are not vireo solitarius but vireo gilvus."

The classic ninth volume of the Pacific Railroad Survey (1858), by Baird, Cassin, and Lawrence, lists four specimens of *Vireo philadelphicus* from Dane County, Wisconsin (Nos. 6842, 4333, 4334, and 6841). I wrote Alexander Wetmore of the Smithsonian Institution for further data on these specimens. He kindly replied as follows:

"With regard to No. 6842, Baird made a curious error in connection with this specimen since it comes from Rockport, Illinois and reached us from Kirtland.

"As for the others, Nos. 4333, 4334 have identical data coming from Dane County, Wisconsin, spring 1854 and listed as 'obtained from' Dr. T. M. Brewer. They were entered in the catalogue October 24, 1854, as *'Vireo gilvus?'*

"No. 6841 comes from Dane County, Wisconsin, September 1855. 'Obtained from' Th. Kumlien. This was catalogued in 1857 as *'Vireo philadelphicus?'*

"None of these specimens is now to be found in our collections."

It is obvious that it was only through Kumlien's persistence that sufficient attention was drawn to the above specimens to have them entered in the Railroad Report as *philadelphicus*.

It would have been well had the vireo affair ended at this point, but this was not to be. Kumlien, in 1859, sent to Henry Bryant, of Boston, some birds' eggs and skins that Bryant had ordered. On November 29, 1859, Bryant wrote a criticism of the quality of the work done on the specimens. Apparently in atonement, he added: "I was informed by several people that it was in consequence of your observation that Cassin was led to describe V. philadelphia and therefore consider you as the discoverer if not the describer." In the Kumlien correspondence is a scrap of paper on which is written to Bryant, evidently in December, 1859, "It pleased you to state in one of your letters that you considered me the discoverer of V[ireo] P[hiladelphia]. Please do tell me why you think so." Bryant's reply, if made, cannot be found. On February 13, 1862, Kumlien wrote to H. Schlegel, Leiden, Holland: "Is not Vireo philadelphica (I was the first that found that bird) ... desirable . . .?"

Brewer, February 9, 1871, asked Kumlien, "Will you oblige me by giving me all the information you can in regard to Vireo philadelphica? What time it arrives in spring or goes in fall, if any remain to breed, its song, wildness or tameness, etc, etc." When writing on the Philadelphia Vireo in 1875, Brewer stated that he was informed by Thure Kumlien that he "has been familiar with this Vireo since 1849, and has collected it every year since that period. ..."[6] Whether the date

1849 should stand is not now determinable. Evidently Kumlien did not collect this vireo every year, for in a letter to Carl Gustaf Lowenhielm, written in 1859, he said: "I haven't this year nor last found one Vireo Philadelph., so if you have not sold all the specimens, it will be wise to not sell them for under price."

Kumlien, as we have seen, came very near being the discoverer of a new species. He knew far more about the bird we now call the Philadelphia Vireo than did Cassin, who named it. Though he cannot be credited with the discovery, Kumlien, through his accurate observations, convinced eastern ornithologists that this vireo was a good species.

References:

[1] P. V. Lawson, *Trans. Wis. Acad. Sci.*, 20 (1921):679.
[2] John Cassin, *Proc. Acad. Nat. Sci. Phila.*, 5 (1851):153.
[3] L. Kumlien and N. Hollister, *Bull. Wis. Nat. Hist. Soc.*, 3 (1903):133.
[4] T. Kumlien, *Proc. Boston Soc. Nat. Hist.*, 6 (1859):109–110.
[5] T. M. Brewer, *op. cit.*:109.
[6] S. F. Baird, T. M. Brewer, and R. Ridgway, North American Birds. Boston, vol. 1 (1873):367–368.

A. W. Schorger, *168 North Prospect Avenue, Madison 5, Wisconsin.*

The Evening Grosbeak in Kentucky.—Since March 1887, when Leon O. Pindar recorded the Evening Grosbeak (*Hesperiphona vespertina*) in the vicinity of Hickman, Fulton County, Kentucky, there has been no record of this species from the State. Pindar (1887, *Auk*, 4:257) observed a small group March 18, 22, 23, and 25, 1887. He saw seven on the last date and apparently collected three. Our efforts to locate these specimens have so far been in vain. There are three specimens of this finch taken just outside of our borders, near Cincinnati, Ohio, March 6, 1911, and two taken in the same locality June 8, 1911 (Woodrow Goodpaster, 1941, *Jour. Cincinnati Soc. Nat. Hist.*, 22:34).

On February 24, 1946, we collected an adult male Evening Grosbeak at Anchorage, Jefferson County, Kentucky. It was sitting all alone in a tree beside Monroe's house. A careful search of the neighborhood failed to disclose more of its kind. The specimen was very fat.

The collection of this specimen definitely establishes the Evening Grosbeak's place on the Kentucky list as a rare, or casual, straggler. The record is of special interest in connection with the marked invasion of Evening Grosbeaks in the northeastern states this winter.—Burt L. Monroe, *Anchorage, Kentucky*, and Robert M. Mengel, *Cornell University, Ithaca, New York.*

To the Members of the Wilson Ornithological Club:

The Annual Meeting of the Wilson Ornithological Club will be held in Omaha, Nebraska, November 29 to 30. A more detailed announcement will appear in the Secretary's letter, which all Members will soon receive, and in the September issue of the *Bulletin*.

Members should be considering what papers they will present, for the titles will be requested in the Secretary's letter above referred to. Information concerning drawings of birds made by men in uniform during the war should be given the Secretary, in case a special exhibit of these can be arranged.

Omaha is admittedly not a centrally located point, but the invitation to meet there was most cordial, certain more easterly cities are faced with a bad housing problem at the moment, and the opportunity to meet with the recently re-affiliated Nebraska Ornithologists' Union is one we cannot afford to miss.

George Miksch Sutton, *President*

June 26, 1946

EDITORIAL

This has been a record year for prompt payment of dues, and the Members deserve our gratitude. Early payment not only saves the Treasurer and the Editor considerable time; it greatly reduces the expense of mailing the *Bulletin*.

To facilitate a complete listing of "Lacks and Desiderata" for the Wilson Ornithological Club Library, all Members are requested to send to the Editor a complete bibliography of their published titles (even though a single title represents their complete bibliography). It would greatly simplify the work if the bibliography were sent to us in duplicate so that one copy can be returned to the Member with checks against those titles that the Club Library lacks and the Member may be able to supply. For convenience of permanent filing, the bibliographies should if possible be typed double-spaced on standard size (8½ × 11) paper.

Dr. Gordon M. Meade asks that records of the Snowy Owl made this past fall and winter in New Jersey, Pennsylvania and states south should be sent to him at the University of Rochester, Rochester 7, New York. He is preparing a report on the New York aspects of the 1945–46 Snowy Owl flight and wishes to include the more southern records. He would like to know the name of the observer; the date and place of each observation; the number of individual observations made; the approximate date for the peak of the invasion in the area; and first and last dates of observation.

John W. Aldrich of the U.S. Fish and Wildlife Service, Washington, D.C., asks for donations of good glossy prints (accompanied by data) of bird photographs taken in the State of Washington. With Stanley G. Jewett, Walter P. Taylor, and William T. Shaw, Dr. Aldrich is preparing a book on the birds of the State.

Contributors are again reminded that the date of publication of a manuscript depends as much on the amount of time required to prepare it for publication as on the date of receipt. Not only careless English, ambiguous expression, and inaccuracies in quantitative data and bibliographical references are in question; such apparently minor details as untidily marked-over manuscript, narrow margins, poor quality paper, and worn-out typewriter ribbons tremendously increase the editor's labors.

OBITUARY

Clinton G. Abbott, for twenty years director of the museum of the San Diego Society of Natural History, died March 5, 1946. In recognition of his very important services to the museum, the Society has established the Clinton G. Abbott Memorial Publication Fund. The income from the fund will be used for an enlarged publication program.

Thomas S. Roberts, familiar to all ornithologists as the author of "The Birds of Minnesota" and "Bird Portraits in Color," died in Minneapolis on April 19 at the age of eighty-eight. Formerly chief of staff at St. Barnabas Hospital, Minneapolis, and Professor of Pediatrics at the University of Minnesota, he became, after his retirement from medical practice in 1913, Professor of Ornithology and director of the Museum of Natural History at the University of Minnesota. His best known work in ornithology, "The Birds of Minnesota," first published in 1932, was awarded the Brewster Medal in 1938. Dr. Roberts had been a member of the Wilson Ornithological Club since 1914.

Ornithological News

The American Ornithologists' Union will hold its Sixty-fourth Annual Meeting at Champaign, Illinois, September 2–5.

Mrs. Walter W. Naumburg, who worked as a research associate under Frank Michler Chapman at the American Museum of Natural History, has founded a Chapman Memorial Fund "to promote the study of living birds of the Western Hemisphere." The income of the fund will be used to establish fellowships for students engaged in special field studies.

Lt. Col. W. P. C. Tenison, Editor of the *Aves* section of the *Zoological Record*, was recently elected Editor of the *Bulletin of the British Ornithologists' Club*.

An advance brochure announces the early publication of what promises to be a very fine (and certainly much needed) book on Chilean birds, by J. D. Goodall, A. W. Johnson, and R. A. Philippi B. The brochure includes sample pages with text and a selection of excellent color plates from paintings by J. D. Goodall. The authors' intentions are so commendable that they seem worth quoting at length: "It has been our aim to produce a comprehensive Manual covering all species and subspecies so far reported from Chilean territory, combining, in so far as possible, the scientific approach with a general text calculated to stimulate interest in the lay reader. Intended primarily for use in Latin-America, the book has necessarily been written in Spanish.

"A separate colour-plate for each bird being out of the question on account of the prohibitive cost, a careful selection has been made of the best known or most representative species in each family or in some cases, genus, so as to give the widest possible coverage and facilitate field identification of the other species by tying in their respective descriptions with the one illustrated. In every case, the drawings have been made from first hand knowledge of the actual bird and its natural surroundings or habitat."

O. J. Murie, the artist and naturalist, who has been a member of the Wilson Ornithological Club since 1934, is the new director of the Wilderness Society.

A. Starker Leopold, Director of Field Research in the Conservation Section of the Pan American Union, received a 1946 Guggenheim Memorial Fellowship for the preparation of a book on the gallinaceous game birds of Mexico.

The headquarters of the British Ornithologists' Union are now at the British Museum (Natural History), South Kensington. Communications for the Hon. Secretary and Treasurer and for the Editor of the *Ibis* should be addressed to them % Bird Room, British Museum (Natural History), Cromwell Road, London, S.W. 7.

Walter J. Breckenridge, the artist and naturalist, has been appointed director of the Minnesota Museum of Natural History to succeed Thomas S. Roberts.

Alexander F. Skutch, known to *Wilson Bulletin* readers for his excellent articles on the birds of Central America, has been awarded a Guggenheim Memorial Fellowship for 1946. He plans to make his headquarters at the University of Michigan Museum of Zoology while preparing a book on the life histories of Central American birds.

Charles W. Schwartz, of Columbia, Missouri, a member of the Wilson Ornithological Club since 1943, has been appointed Biologist of the Board of Agriculture and Forestry of the Territory of Hawaii. He will be in charge of the wildlife conservation and game management program.

ORNITHOLOGICAL LITERATURE

A LABORATORY AND FIELD MANUAL OF ORNITHOLOGY. By Olin Sewall Pettingill, Jr. Burgess Publishing Company, Minneapolis, revised ed., 1946: 8½ × 11 in., vi + 248 pp., illustrated by Walter J. Breckenridge. Ring or staple binding. $3.50.

This manual represents a work of great value to teachers and students of ornithology. The wealth of critically selected material which it contains is useful not only in teaching but also in research. The text is clearly written and well organized, but more important than even these desirable features is the degree to which this manual views birds from the standpoint of general biological problems.

The text is divided into 18 sections; each gives an outline of basic information, instructions for study, and (with three exceptions) a bibliography. The first 10 sections are designed for a spring or summer introductory course and deal with the following: topography of the bird, feathers and feather tracts, internal anatomy, classification and nomenclature, external structural characters, laboratory identification, plumages and plumage coloration, distribution and migration, field identification, and bird ecology. The remaining 8 sections are intended for an advanced summer course and deal with communities, territory, mating, nests and nest-building, eggs and incubation, young and their development, parental care, and bird populations.

The descriptive sections on anatomy leave little to be desired. For an introductory course, they are comprehensive, yet compact. Instructions are set forth with special effort to save a student's time by enabling him to focus attention on critical detail. Certain parts of the section on internal anatomy might be considered irrelevant, but the section is "not included in required laboratory work."

Perhaps the weakest part of the entire manual is that dealing with classification and nomenclature. The definition of "characters" (p. 53) might be clearer if it read "*distinctive or peculiar* points of structure or of habit." It should be made absolutely clear to the student that classification rests on characters that are *diagnostic* (a word not used in the section). The unmodified statement that subspecies "differ minutely" would seem to promote beginners' and non-systematists' misunderstanding of the bases and significance of subspecific distinctions. A thinking student will wonder why so many ornithologists concern themselves with subspecies. Just a sentence or two, with references to pertinent discussions in Mayr's book and other sources, would help. A hint that classification schemes are not static might be provided by the statement that there is a tendency, at present, toward elimination of subgenera in such "standard works" as the A.O.U. Check-List and that the category "superspecies" has never been used in that work. Pettingill suggests (p. 56) that the student "habitually rely upon it [the A.O.U. Check-List] for the proper presentation of all technical and vernacular . . . names." But for vernaculars in general, Peterson's Field Guides are a better source. The bibliography of this section does not list the works of Ridgway, Ridgway and Friedmann, or Hellmayr, all of which seem worthy of inclusion.

The sections on ecological factors, communities, and populations deal in concise and apt fashion with topics not easy to present. Here two points are worth some comment. First, in the procedure suggested for the study of bird communities (p. 142), separate mention is made of "effect of edge" and "effect of ecotones." But an edge may be considered an ecotone, usually a sharp one. Ecotones or transitions may be sharp or gradual, local or regional. "Edge" is a term of more restricted meaning, but the principle is the same, namely, community interdigitation, intermixture, or juncture. The second point is the fact that in the section on populations, equal emphasis is given to measurements of absolute abundance and

those of relative abundance. The author, as a teacher, has excellent opportunity to encourage counts of actual populations and to point out the limitations of measurements of relative abundance. I have the impression that the latter often serve as an excuse for merely pleasurable "birding." The inclusion of road censuses (p. 202) as a method of measuring relative abundance may lead some students to take this "game" seriously.

Additional useful information is organized in seven appendices, as follows: Ornithological Field Methods; Preparation of a Paper; Bibliographies Pertaining More or Less to Ornithology; Bibliography of Life History Studies (including unpublished theses); Selected Bibliography of State Works on Birds; Books for General Information and Recreational Reading; Current North American Ornithological Journals. The bibliography of State works is of deliberately restricted scope, but the following additions seem worthwhile and significant supplements to the listed works: Brewster on the Lake Umbagog region of Maine (1937. *Bull. Mus. Comp. Zool.*, 66:1–620), Griscom and Crosby on southern Texas (1925–26. *Auk*, 42:432–440, 519–537; 43:18–36), Linsdale on the Great Basin (1938, *Amer. Midl. Nat.*, 19:1–206), and van Rossem on the Charleston Mountains of Nevada (1936. *Pacific Coast Avifauna No.* 24:1–65). B. T. Gault's "Check List of the Birds of Illinois" (Ill. Aud. Soc., 1922) is a list published earlier than Schantz' "Birds of Illinois" (1928) cited by Pettingill, but is, nevertheless, the more informative of the two. These, however, are minor points. Perhaps the only real criticism to be made of this bibliography is that it ignores Canada: Taverner's works, for instance, are nowhere cited.

The entire manual leads one to reflect on the pedagogic method of approach. Perhaps there is a danger that simplification in a manual of this type may become excessive; that in trying to cover a large amount of information the student may spend too much time filling in blanks and adding detail to base drawings without knowing why. But the extent to which this is a real danger depends not on the manual but on the teacher and on his demands in terms of the available time. Some will perhaps wonder if the rather detailed outlines Pettingill provides for the study of breeding biology would not stifle student originality. Here, however, I believe the approach of this manual is in the long run the most successful.

The manual is distinctly more than an entry book of details on the characters of bird groups, their world distribution, and the identification of local avifaunae. Although designed for teaching-needs, the manual can also serve—if only for its excellent bibliographies—as a handbook to investigators and as a check-list of the desired types of information on breeding biology.—Frank A. Pitelka.

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See also *Physiology:* Elder; *Distribution and Taxonomy:* Aldrich; *Life History and Behavior:* Bryens; *Food and Feeding Habits:* Nestler.

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See also *Distribution and Taxonomy:* Mayr.

To the Editor of The Wilson Bulletin:

It may interest some of your readers to know that I have a contract with Dodd, Mead and Company, 432 Fourth Ave., New York 16, N.Y., to publish a reprint of my Bulletin 107, Life Histories of North American Diving Birds. It will probably appear some time next fall or winter.

The price and the format will be announced by the publishers in due course.

As the edition will be limited by the probable demand, it might be wise for those who lack this number to notify the publishers that they would like to have an opportunity to purchase a copy.

If the demand seems to warrant it, some of the other rare numbers may be reproduced.

Taunton, Massachusetts. A. C. BENT
May 6, 1946

WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received. From:

William C. Baker—1 book (typed transcription)
B. W. Cartwright—2 reprints, 8 journals
William C. Grimm—2 books
K. A. Hindwood—1 book, 4 reprints
Margaret M. Nice—13 reprints, 6 journals
W. H. Phelps—1 reprint
Frank A. Pitelka—2 books, 44 journals 1 reprint
Thomas L. Quay—2 books
A. W. Schorger—1 reprint
Carl Stromgren—14 pamphlets and reprints
R. M. Strong—2 reprints
Gordon Wilson—4 reprints

WILDLIFE CONSERVATION

The Ring-Necked Pheasant and Its Management in North America *

This book, published in November 1945 by the American Wildlife Institute, Washington, D. C., presents the findings of a series of researches on pheasants conducted by seven land-grant colleges with the help of the respective state conservation departments and the supervision of the U. S. Fish and Wildlife Service. Michigan contributes an additional research conducted independently. In addition, there are chapters on classification and artificial propagation of pheasants.

The eight regional chapters differ greatly in viewpoint and technique. Some are casual surveys; others are based on ecological research of a high order. W. L. McAtee undertook the difficult editorial task of welding these diverse materials into a book. The result is better than might be expected of so heterogeneous a mixture of authorships and auspices.

The critically reasoned chapter on the pheasant in Ohio, by Daniel L. Leedy and Lawrence E. Hicks, excels the work from other states in both quality and volume. Every page, bristling with quantitative measurements in pheasant ecology, is a compressed summary of material that would ordinarily be reported as a separate paper. In fact, the main defect of the Ohio work is that its findings are so abundant that many of the detailed data and methods of analysis are omitted for lack of space.

The concept of game research in the agricultural colleges dates from the 1920's, when it first became clear that farm-game populations are controlled mainly by soil, farming practices, and farmers, rather than by game laws, game farms, and sportsmen. The Ohio pheasant study is a monumental elaboration of this concept. Not only are pheasant population levels shown to reflect the general pattern of soils and crops, but also to reflect such seemingly unimportant details as the speed of mowing machines, the selection of hay species, the date of last cultivation, the maintenance of fences and ditches, and the social organization of neighborhoods. We recall no equally thorough integration of wildlife ecology and land-use. Those readers who are not particularly interested in pheasants should be reminded that an equally intimate soil-farmer-animal relationship probably exists among numerous other birds and mammals, but remains to be explored.

With all its merits, this book presents certain defects which, if now clearly defined, may perhaps be avoided in the monographs on other game species now "in the mill" for future Wildlife Institute publication.

The most important is that none of the seven agricultural colleges looked further inside the pheasant than its crop or gizzard for explanations of its success or failure as a game bird. Their work was done during a decade when biochemistry and endocrinology were making spectacular advances in helping animal husbandry, poultry science, and medicine explain hitherto insoluble problems. Why did wildlife managers, quartered on the same campus, fail to seek similar help? In our opinion, the answer lies at least in part in an ill-advised mandate to be "practical," i.e. to choose lines of research whose results could be applied quickly to management problems. By and large the researches here reported are good to the extent that this mandate was disregarded or circumvented. (Ironically enough, the Fish and Wildlife Service is now justly proud of its very recent work on the vitamin nutrition of quail.† Encouragement of similar work in pheasants might have greatly enriched this volume.)

A second weakness is that the book is not up to date. The bibliography contains only one title later than 1942, and the argument shows unawareness of important recent publications, some comparable in quality with the Ohio study.

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* American Wildlife Institute, Washington, D.C., 1945: 6 × 8¾ in., 320 pp., 31 pls. (2 col.), 12 figs. $3.50.

† Nestler, Ralph B. Vitamin A, Vital Factor in the Survival of Bobwhite. Unpubl. MS read at Eleventh North American Wildlife Conference, New York, March 11, 1946.

Parts of the Michigan chapters were written a decade ago, and show it in outmoded and unsupported assertions.

A third weakness is the authors' apparent unawareness of recent advances in the study of bird behavior. For example, it is now widely known that pheasants reared in captivity show a low survival rate where they are in competition with wild pheasants. Might this not arise from the imprinting of abnormal behavior patterns on juveniles while in confinement? Such a possibility is not mentioned, nor can we detect the idea anywhere in the book.

Again, what are we to think about the widely-alleged damaging competition offered to native game birds by pheasants? Errington (p. 198) is the only author who even suspects dominance phenomena. Several others dismiss the question with the remark that no fights have been observed.

We, as readers, would have liked this book better if it offered a chapter summarizing the several regional studies. We would have liked the book better if more of its arguments ended with a flat "I don't know." We would have liked it better if somebody, a decade ago, had started pheasant research in the Dakotas—it does not speak well for "planning" that all pheasant research, until very recently, has been confined to habitats which, in comparison with Dakota, are more or less marginal.

As a piece of technical writing, the book is a monument to its editor. Its style is simple, direct, and uncluttered by "scientific jargon." Except for two color plates, the illustrations (31 plates and 12 figures) are good. It is too bad that the outlay for the color plates was not applied to Walter Weber's handsome painting, which is reproduced as an uncolored frontispiece.—Aldo Leopold and Robert A. McCabe.

Conservation News

The Wildlife Society Award for 1945 was made to the authors and editor of "The Ring-Necked Pheasant and Its Management in North America".

Ira N. Gabrielson, who retired this year as director of the U. S. Fish and Wildlife Service, has accepted the presidency of the Wildlife Restoration Institute, which is replacing the American Wildlife Institute. The new organization will carry on the former activities of the Wildlife Institute, including the sponsorship of the annual North American Wildlife Conference. In addition, it is establishing "a complete service and research organization better to correlate and advance the activities of cooperating agencies in the field of wildlife restoration and conservation."

Duck Hunting Unlimited. "During the fall season of 1943, 1,169,352 [duck stamps] were sold. In 1944, the number jumped to 1,487,029, an increase of about 27%. During the first six months of this fiscal year, which included the last hunting season, more stamps were sold than during all of the year before. In fact, on last December 31st, the duck stamp sales had reached the highest point in history, 1,540,468."—Albert M. Day, in an address to the Eleventh North American Wildlife Conference, March 12, 1946. Day thus presented what he called the "cold facts": "We have overshot our annual increase during the past two hunting seasons.—The population has declined in those two years.—The annual regulations provide the only quick means of adjusting hunting pressure to supply.—Marsh restoration and protection are highly important.—Mother Nature is the prime factor in production. . . . We can do much to improve wintering conditions.—Better public understanding is essential."

The Directors of the National Audubon Society recommended the following changes for the 1946–47 waterfowl hunting season:

1. Reduce the length of open season from 80 to 30 days.

2. Reduce the bag limit from 10 to 5 birds per day, with possession limit the same as the bag limit.

WILDLIFE CONSERVATION COMMITTEE
Frederick N. Hamerstrom, Jr., *Chairman*

CONSTITUTION AND BY-LAWS OF THE WILSON ORNITHOLOGICAL CLUB *

As adopted December 29, 1930, and amended by the Executive Council on August 11, 1944, and October 13, 1945. The Constitution and By-laws as published here will be voted on by the Members of the Club at the next Annual Meeting.

CONSTITUTION

Article I

Name and Object

Section 1. The organization shall be known as "The Wilson Ornithological Club."

Section 2. The object of The Wilson Ornithological Club shall be to advance the science of ornithology, particularly field ornithology as related to the birds of North America, and to secure cooperation in measures tending to this end by uniting in a group such persons as are interested therein, facilitating personal intercourse among them, and providing for the publication of the information that they secure.

Article II

Membership

Section 1. The membership of this club shall consist of six classes: Associate Members, Active Members, Sustaining Members, Life Members, Patrons, and Honorary Members.

Section 2. Any person who is of good moral character and in sympathy with the object of this club may be nominated for membership. Nominations and applications for membership shall be made through the Secretary. Applications for membership shall be endorsed by at least one member. Members shall be elected at the annual meeting by a majority of the members present. Nominations presented in the interim between annual meetings shall be received and confirmed by the Secretary, subject to ratification at the next annual meeting.

Section 3. The annual dues of Associate Members shall be two dollars ($2.00); of Active Members, three dollars ($3.00); of Sustaining Members, five dollars ($5.00). Any member may become a Life Member, exempt from further dues, by making a payment into the endowment fund of the Club of one hundred dollars ($100.00). Any member may become a Patron, exempt from further dues, by making a payment into the endowment fund of the Club of five hundred dollars ($500.00) or more. Upon the unanimous recommendation of the Executive Council, honorary membership may be conferred by the Club by a three-fourths vote at any annual meeting.

Section 4. All members shall be entitled to vote, and all except Associate Members shall be entitled to hold office.

Section 5. All annual dues for the ensuing year shall be due on January 1. Any member in arrears for dues for one year shall be dropped from the roll of members, provided that two notices of delinquency, with an interval of two months between them, shall have been sent to such member.

Article III

Officers

Section 1. The officers of this club shall be a President, two Vice-Presidents, a Secretary, a Treasurer, and an Editor. The duties of these officers shall be those usually pertaining to their respective offices.

Section 2. All officers except the Editor shall be elected at the annual meeting by ballot of the members. The Editor shall be elected annually by the Executive Council.

* Incorporated under the laws of the State of Illinois on October 16, 1944.

Section 3. Officers shall hold office for one year, or until their successors are elected, and shall be eligible for re-election. Their term of office shall begin at the close of the meeting at which they are elected.

Section 4. The officers of the Club, all past Presidents of the Club, and three additional members who shall be elected by ballot of the Club, shall constitute an Executive Council. The Executive Council shall also constitute the Board of Directors of the Corporation. The business of the Club not otherwise provided for shall be in the hands of the Executive Council, which shall pass upon any urgent matters that cannot be deferred until the next annual meeting. Five members of the Council shall constitute a quorum.

Section 5. Vacancies in the staff of officers, occurring by death, resignation, or otherwise, shall be filled by appointment of the Executive Council, but the person so appointed shall hold office only until the close of the next annual meeting of the Club, except in the event of his election to that office by the members of the Club.

Article IV

Meetings

Section 1. The Executive Council shall determine the time and place of meetings of the Club.

Section 2. Twenty-five (25) members shall constitute a quorum for the transaction of business.

Article V

Accounts

Section 1. A committee of two shall be appointed annually by the President to audit the accounts of the Treasurer.

Section 2. The proper care of an Endowment Fund shall be provided for by a Board of Trustees. This Board shall consist of three members appointed by the President, one member for one year, one for two years, and one for three years. At the expiration of each respective term, a member shall be appointed for three years. Any vacancy on the Board, occurring by death, resignation, or otherwise, shall be filled for the unexpired term.

Article VI

Amendments

Section 1. This constitution may be amended at any annual meeting by a two-thirds vote of the members present, provided that the amendment has been proposed at the preceding annual meeting or has been recommended by a two-thirds vote of the Executive Council, and a copy has been sent to every voting member of the Club at least one month prior to the date of action.

Article VII

By-laws

Section 1. By-laws may be adopted or repealed at any annual meeting by a majority vote of the members present.

BY-LAWS

1. Notice of all meetings of the Club shall be sent to all members at least one month in advance of the date of the meeting.
2. The time and place of the business session shall be published prior to the opening session of the annual meeting.
3. A program committee, of which the Secretary shall be chairman, and a local committee on arrangements for the annual meeting shall be appointed by the President at least ninety days in advance of the meeting.
4. Election of officers, except the Editor, shall be by ballot, but by the unanimous consent of the members, the Secretary may cast one ballot, representing

the unanimous vote of the members present. A nominating committee shall be appointed by the President at the beginning or in advance of the annual meeting, which shall offer nominations of officers to serve the Club during the ensuing year. Nominations may also be made by any member in good standing from the floor.

5. A committee on resolutions, consisting of three members, shall be appointed by the President at the beginning or in advance of the annual meeting.
6. The accumulation and care of one or more Wilson Ornithological Club Libraries shall be provided for. A library committee of three or more members shall be appointed annually by the President.
7. The Executive Council shall have power to expel any person found unworthy of membership in the Club.
8. The official organ of the Club shall be *The Wilson Bulletin*. It shall be sent to all members not in arrears for dues.
9. Any member three months in arrears for dues shall be ineligible to vote or to hold elective office in the Club.
10. The fiscal year of this Club shall be the calendar year.
11. The order of business at regular annual meetings shall be as follows:
    1. Calling of meeting to order by the President.
    2. Reading and approval of minutes of the previous meeting.
    3. Reports of officers.
    4. Appointment of temporary committees.
    5. Election of members.
    6. Business.
    7. Reports of committees.
    8. Election of officers.
    9. Adjournment.

    The program may be interpolated in the order of business according to convenience.
12. The rules contained in Roberts' Rules of Order shall govern the Club in all cases to which they are applicable and in which they are consistent with the Constitution and By-laws of the Club.
13. If no annual meeting can be held, election of officers may be conducted by a mail ballot.
14. This constitution may be amended by mail ballot provided that the amendment has been recommended by a two-thirds vote of the Executive Council, and a copy has been sent to every voting member of the Club at least two months prior to the date of action.

REPORT OF THE TREASURER FOR 1945

Balance as shown by last report, dated Dec. 31, 1944		$ 522.00
Receipts, Jan. 1 to Dec. 31, 1945		
Dues:		
Associate	1414.25	
Active	1194.05	
Sustaining	355.50	
Subscriptions to *The Wilson Bulletin*	167.00	
Sale of back issues of *The Wilson Bulletin* and of reprints	145.32	
Interest from Endowment Fund	82.00	
Contributions for printing of colored and insert plates	287.80	
Gifts: miscellaneous receipts	9.40	
Total receipts		$4177.32

Disbursements			
The Wilson Bulletin: printing, engraving, mailing	2588.98		
President's expense: printing, postage	2.56		
Editor's expense: reprints, postage, secretarial aid	163.99		
Secretary's expense: stationary, postage	44.23		
Treasurer's expense: stationary, postage, clerical aid	58.28		
Membership Committee expense: postage, printing	45.00		
Bank charges; foreign exchange; corporation papers	27.54		
Bad checks	15.00		
Transferred to Endowment Fund savings account	690.14		
Total disbursements		$3635.72	
Balance transferred to new Treasurer, Burt L. Monroe		541.60	
			$4177.32

Endowment Fund

Cash balance in savings account, Dec. 31, 1944	$ 45.24		
Received during year:			
Interest on U. S. bonds and on savings account	82.00		
Sale of U. S. Savings Bonds	900.00		
Life Membership payments	1020.00		
Gifts	35.00		
Transferred from checking account	690.14		
Total		$2772.38	
Transferred to checking account (interest)	82.00		
Purchase of U.S. Savings Bonds, Series G, July 17 ($900.00) and Oct. 19, 1945 ($1400.00)	2300.00		
Total		2382.00	
Balance			$ 390.38
Bonds:			
U. S. Postal Savings Coupon Bonds, dated July 1, 1935			780.00
U. S. Savings Bonds (maturity value Aug. 31, 1948: $1075.00) purchase value			806.25
U. S. Savings Bonds, Series G, dated Sept. 1, 1943			1000.00
U. S. Savings Bonds, Series G, dated Dec. 20, 1944			1500.00
U. S. Savings Bonds, Series G, dated July 1, 1945			900.00
U. S. Savings Bonds, Series G, dated Oct. 1, 1945			1400.00
Total Endowment Fund, transfered to new Treasurer, Burt L. Monroe, Dec. 31, 1945			6776.63

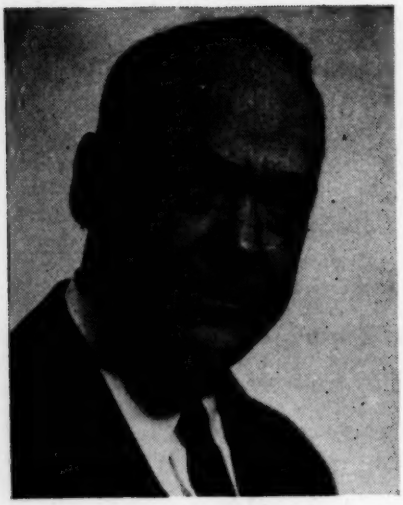
Respectfully submitted,

Milton B. Trautman, *retiring Treasurer*

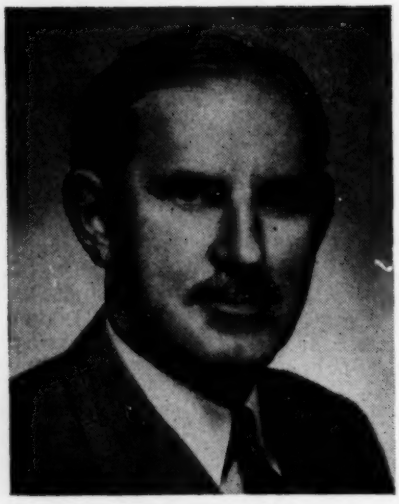
December 31, 1945

Approved by Auditing Committee
James B. Young
Leonard C. Brecher

NEW LIFE MEMBERS



CECIL BILLINGTON has long been associated with the Evening News Association and with Booth Newspapers, Inc. of Detroit. His important contributions to horticulture and to systematic botany have been recognized by his appointment as Honorary Curator of Phanerogams in the University of Michigan Herbarium and by the award of the Esther Longyear Murphy Medal "for distinguished service to horticulture." He is a Trustee of The Cranbrook Foundation and of Cranbrook Institute of Science. His publications include several papers on Michigan flowering plants and ferns and a book (1943) on the shrubs of Michigan.



DR. ALEXANDER W. BLAIN, a founder of the American College of Surgeons and of the American Board of Surgeons, is now Professor of Surgery at Wayne University and Chief of Staff of the Alexander Blain Hospital and Clinic, Detroit. He serves on the editorial board of several surgical journals and is the author of numerous papers on surgery. But in addition, he takes an active and enthusiastic interest in the fields of botany, mammalogy, and ornithology. He has been a member of the Wilson Ornithological Club since 1902. In 1903 he issued the call which led to the reorganization of the Michigan Ornithological Club. He edited its "Bulletin" through 1903 and 1904 and was Secretary of the Club in 1905. With Jefferson Butler he organized the Michigan Audubon Society in 1904. He was a member of the Michigan State Conservation Commission from 1939 to 1945.

TO OUR CONTRIBUTORS

Our members are asked to submit articles for publication in the *Bulletin*. Manuscripts will be accepted only with the understanding that they have not previously been published or accepted for publication elsewhere.

MANUSCRIPT. Manuscripts should be typed, with double-spacing and wide margins, on one side of white paper of good quality and of standard size (8½ x 11). The title should be brief and should indicate the subject clearly. Ordinarily the scientific names of the birds treated should be given and should appear early in the article. Most articles should conclude with a brief summary.

BIBLIOGRAPHY. Literature referred to in the text should be cited by author's name, year of publication, and exact page of the particular reference. Such literature should ordinarily be listed in full at the end of the paper.

ILLUSTRATIONS. Photographic prints, to reproduce well as half-tones, should have good contrast and detail. Please send prints unmounted, and attach to each print a brief but adequate legend. Do not write heavily on the backs of photographs.

PROOF. Authors are requested to return proof promptly. Expensive alterations in copy after the type has been set must be charged to the author.

REPRINTS. Orders for reprints, which are furnished to authors at cost, should accompany the returned galley proof.